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THE ROLE OF THE CERVICAL SYMPATHETIC GANGLIA AND MÜLLER'S ORBITAL MUSCLE IN EXPERIMENTAL EXOPHTHALMOS*

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A tonic contraction of Müller's orbital muscle has been frequently cited as the immediate cause of proptosis in both clinical and experimental exophthalmos. Activation of Müller's muscle of the lid and orbit through sympathetic stimulation by drugs, toxins, and electric current causes some proptosis and widening of the palpebral fissure in experimental animals (MacCallum and Cornell,[1] Code and Essex,[2] Marine, Spence, and Cipra).[3] Such evidence coupled with the production of ptosis and enophthalmos by removal of the cervical sympathetic ganglia forms the basis of the concept that the action of the sympathetic nerves and smooth musculature of the orbit is responsible for exophthalmos found clinically. This theory carries with it the assumption that the swelling of the orbital tissues and the pathological changes found in clinical cases are secondary. In addition such hypotheses ignore the great difference in the orbital anatomy of man and laboratory animals.

In man, Müller's orbital muscle consists of a narrow band of smooth muscles, a few millimeters in width, bridging the inferior orbital fissure.[4, 5] Because of the extent and distribution of its fibers it is generally agreed among anatomists that it is incapable of creating sufficient pressure on the orbital content to produce an exophthalmos. This may explain why McCallum and Cornell[1] failed to observe exophthalmos following attempts to stimulate Müller's muscle in man by applying an electric current to the cervical sympathetic ganglia. However, the Müllerian orbital muscle of the common laboratory animals consists of an extensive thin sheet of connective tissue and smooth muscle fibers that spans a wide inferior orbital fissure and forms the entire floor of the orbit. Since the orbital contents rest on, and to some extent are supported by, this muscle its contraction can create pressure behind the eye and cause some proptosis.

Within recent years it has been shown that injection of an extract of pituitary gland produces an exophthalmos very similar to the clinical type (Schockaert,[6]

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PLATE 4 (SMELSER).

FIG. 1. DRAWING OF A DISSECTION OF A GUINEA-PIG ORBIT SHOWING MUELLER'S MUSCLE. L. LACRIMAL GLAND; F, SUBCUTANEOUS FASCIA INCLUDING ORBICULARIS AND ORBITAL SEPTUM; T, TENDON; M.M. MUELLER'S ORBITAL MUSCLE; Z, ZYGOMATIC ARCH. C.P., CORONOID PROCESS OF THE MANDIBLE; M.P., MUSCULUS PTERYGOIDEUS

FIG. 2. NORMAL EYE OF A CONTROL GUINEA-PIG.

FIG. 3. EYE OF A CONTROL GUINEA PIG FOLLOWING REMOVAL OF MUELLER'S ORBITAL MUSCLE. THE SYMPATHETIC INNERVATION IS COMPLETE.

FIG. 4. EYE OF CONTROL GUINEA PIG SHOWING THE PTOSIS CAUSED BY EXTIRPATION OF THE CERVICAL SYMPATHETIC GANGLION. MUELLER'S ORBITAL MUSCLE IS INTACT. COMPARE WITH FIGURES 2 AND 3.

FIG. 5. EYE OF A CONTROL GUINEA PIG AFTER REMOVAL OF BOTH THE CERVICAL SYMPATHETIC GANGLION AND MUELLER'S ORBITAL MUSCLE. COMPARE WITH FIGURES 3 AND 4.

Loeb,[7] Smelser,[8] Friedgood[9]). In addition to the ocular signs, a thyroid hyperplasia is developed by this treatment which closely resembles that found in Graves's disease (Loeb and Bassett,[10] Severinghaus[11]). The exophthalmos can be produced in thyroidectomized animals (Marine *et al.*,[12] Smelser[13]) and is more extreme in hypo- than in hyperthyroidism (Smelser[14]). The orbital contents of these animals are increased in weight, all of the retrobulbar tissues being involved excepting the ventral lacrimal gland, which lies below and temporal to the globe (Smelser[13]). The hypertrophy of the fat and muscles assumes particular importance because of the similar condition of these structures in cases of clinical exophthalmos (Burch,[15] Thomas and Woods,[16] Naffziger,[17] Moore,[18] and Thomson[19]). The similarity is further emphasized by the pathological changes found in these tissues. Sections show an invasion of the muscles and, to a greater degree, of the fat by an edematous infiltrate accompanied by lymphocytes. The infiltrating material is similar in appearance and staining properties to that found in clinical cases.[8, 13] The proptosis in this type of exophthalmos persists *post mortem*, and the amount of edematous infiltrate as well as the increase in retrobulbar tissue is unaffected by removal of the cervical sympathetic ganglia. Since it appears that an exophthalmos closely approaching the type found clinically has been produced it is of great importance to determine if Müller's orbital muscle is involved in these changes.

Even though the proptosis so produced is not caused directly by contraction of the smooth-muscle fibers, it is conceivable that by their action on the veins draining the orbit some of the effects noted might occur. Removal of the cervical sympathetic ganglia, as done in the earlier experiments, does not obviate the possibility that the exophthalmos-producing factors contained in the extracts may act directly on the denervated smooth-muscle fibers. For these reasons a series of experiments has been carried out to determine whether or not extirpation of Müller's orbital muscle or of the sympathetic ganglia modifies experimentally produced exophthalmos.

Methods

Forty-seven young adult guinea pigs were thyroidectomized. In approximately one third of the animals the cervical sympathetic ganglia and fibers were left intact. In the second group the sympathetic ganglia on the right side only were removed and in the third group the ganglia were removed bilaterally. After a short recovery period Müller's orbital muscle was removed from the right orbit of all animals in each group.

Under ether anesthesia an incision was made through the skin just over the zygomatic arch, curving upward temporally between the eye and ear. The skin was then undermined and separated from the underlying fascia, which consists of the orbicularis and orbital septum. This fascia was then incised, care being taken not to injure the facial nerve. In this manner the ventral lacrimal gland was exposed and retracted as shown in figure 1. This procedure exposed Müller's orbital muscle from below so that with careful illumination each step of its dissection could be seen. During this procedure the globe was protected with ointment. After removal of the thin sheet of muscle the lacrimal gland was replaced, and the skin and fascia sutured separately. Recovery has always been uneventful, the moderate reaction subsiding within one or two days.

Following a one or two weeks' recovery period, the guinea pigs were injected with an anterior pituitary extract for ap-

proximately 45 days. An amount of extract equivalent to 200 mg. acetone-dried, beef-anterior-pituitary glands was given daily for three weeks and then increased to 400 mg. for two weeks. During the final 10-day period the dosage administered was 500 mg. daily. The extract was prepared as described earlier (Smelser[20]), and was essentially a well-tolerated preparation that contained a mixture of gonad, thyroid, adrenal, and probably growth-stimulating hormones. At the end of the injection period the animals were killed with illuminating gas and an autopsy was performed.

Results

Removal of the cervical sympathetic ganglia produced, as expected, marked ptosis and enophthalmos (fig. 4*). The enophthalmos undoubtedly resulted from the relaxation of the orbital muscle of Müller, and the ptosis from a similar condition of the unstriped muscle in the lids. These effects are, to a considerable degree, apparently permanent in the guinea pig, for they have persisted in some animals for well over a year and a half.

Extirpation of Müller's orbital muscle produced a marked, permanent effect on the position of the globe. Due to the removal of the support of the orbital contents, the globe sank inward so that a definite enophthalmos occurred. In a sense this operation may be compared with that of a decompression of the orbit. Here the floor of the orbit was destroyed and its contents allowed to expand downward instead of upward as in the clinical cases when the roof of the orbit has been removed. Associated with this enophthalmos a ptosis occurred (fig. 3) which probably was the result of at least two factors. Because of the regression of the bulb into the orbit some support of the lids was withdrawn, thus allowing them to droop. A second factor which may have affected the lower lid was the formation of connective tissue following the operative procedure. In view of the excellent mobility of the lids in these animals it does not seem probable that this was of prime importance. The degree of enophthalmos produced by removing Müller's muscle was apparently greater than that obtained by extirpation of the cervical sympathetic ganglion. Unilateral removal of the orbital muscle of a guinea pig from which the sympathetic ganglia have been taken out on both sides resulted in a more marked enophthalmos on the side operated on (figs. 5 and 8). This would seem to indicate that, although relaxed, when deprived of its innervation the smooth muscle sheet still offers considerable support to the orbital contents.

Injection of the pituitary extract produced a definite exophthalmos in 23 of the 28 experimental animals, a proportion of positive responses comparable to that obtained in other experiments. Exophthalmos was easily detected in the normally innervated eyes that were not operated on, but in those cases in which a ptosis had been created by removal either of the sympathetic fibers or Müller's muscle a careful comparison with controls that had undergone operation was necessary (fig. 7). Ptosis tended to minimize the degree of proptosis because in the living animal the position of the globe is judged largely on its relation to the lids. In addition, all of the eyes with a ptosis were enophthalmic at the beginning of the treatment. However, following careful examinations it appeared that surgical removal of the smooth muscle of

*All of the guinea-pigs figured had been thyroidectomized, and in those specimens from which either the cervical sympathetic ganglia or Müller's muscle had been removed the photographs were taken after recovery was complete. The control animals were not injected. The photographs of the guinea pigs were prepared by Mr. Adolph Marfaing.

the orbit and/or of the sympathetic ganglia innervating it did not seem sensibly to delay protrusion of the globe. In all cases the proptosis eventually obtained did not equal that found in the eyes that were not operated on. Due to this inequality, most of the animals appeared to have a unilateral exophthalmos (fig. 7).

Because of the difficulty in judging the degree of exophthalmos in the living guinea pig a careful examination was made at autopsy after removal of the skin and lids, where the relation of the globe to skull and orbit could be readily determined. Under these conditions the effects of injections on normal orbits and those operated upon were readily demonstrable.

The enophthalmos caused by removing the orbital muscle was clearly seen in the skinned post-mortem preparations of controls. Ablation of the sympathetic ganglia, however, is apparently without this effect. Therefore, in all of the animals the eye that was not operated upon was slightly more prominent than the other (figs. 12, 13, 14).

In all three groups of animals the effect of anterior-pituitary injections on the post-mortem protrusion of the globe was marked. A definite exophthalmos was produced in normally innervated orbits, both the intact and those that had been operated on (fig. 9). In the second group the sympathetic innervation to the right eye had been removed together with the smooth muscle. The exophthalmos in these animals was indistinguishable from that of the first series (fig. 10). The cervical sympathetic ganglia were removed on both sides of the animals of the third group. In these it can be seen that exophthalmos produced by hypophyseal injections is independent of both the sympathetic nerves and Müller's smooth orbital muscle (fig. 11). Some inequality in the protrusion of the eyes was seen in all of the exophthalmic animals, just as noted in the controls.

At autopsy the orbital contents were removed and carefully dissected. The orbital fat, both lacrimal glands, the extraocular muscles, and bulb were weighed separately and fixed for histological examination. In all cases the tissues of the orbits that had been operated on were healthy, and the circulation was normal. Some increase in the amount of connective tissue in the orbits from which the smooth muscle had been removed was found, which probably resulted from the operative trauma. This reaction was sufficient to increase the average weight of the retrobulbar tissue of the orbits oper-

PLATE 5 (SMELSER).

FIG. 6. A GROUP-I CONTROL. THE LEFT EYE IS NORMAL, THE RIGHT IS ENOPHTHALMIC DUE TO REMOVAL OF MUELLER'S ORBITAL MUSCLE. THE SYMPATHETIC NERVES ARE INTACT.

FIG. 7. AN EXOPHTHALMIC GUINEA PIG OF GROUP I. BOTH EYES ARE NORMALLY INNERVATED, AND MUELLER'S MUSCLE HAS BEEN REMOVED, O.D. COMPARE WITH FIGURE 6.

FIG. 8 A GROUP-III CONTROL GUINEA PIG. THE CERVICAL SYMPATHETIC GANGLIA HAVE BEEN REMOVED BILATERALLY AND MUELLER'S MUSCLE FROM THE RIGHT ORBIT. COMPARE WITH FIGURE 6.

FIG. 9.* A GROUP-I EXOPHTHALMIC GUINEA PIG. THE CERVICAL SYMPATHETIC GANGLIA ARE INTACT BUT MUELLER'S MUSCLE HAS BEEN REMOVED O. D. NOTE THE SLIGHT DIFFERENCE IN PROTRUSION BETWEEN THE RIGHT AND LEFT EYES. COMPARE WITH FIGURES 11 AND 12.

FIG. 10.* A GROUP-II EXOPHTHALMIC GUINEA PIG. THE SYMPATHETIC INNERVATION AND MUELLER'S ORBITAL MUSCLE OF THE RIGHT EYE HAD BEEN REMOVED. THE INNERVATION OF THE LEFT EYE IS NORMAL. COMPARE THE RIGHT EYE WITH THAT IN FIGURE 9 AND THE CONTROL, FIGURE 13.

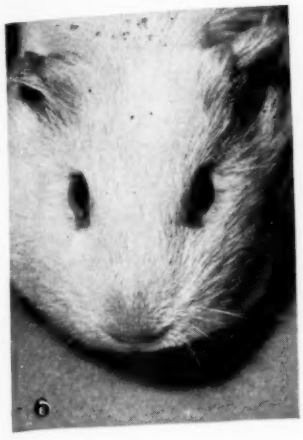
FIG. 11.* A GROUP-III EXOPHTHALMIC GUINEA PIG. THE CERVICAL SYMPATHETIC GANGLIA HAD BEEN REMOVED BILATERALLY, AND MUELLER'S MUSCLE FROM THE RIGHT ORBIT. NOTE THE DIFFERENCE IN PROTRUSION BETWEEN THE RIGHT AND LEFT EYES. COMPARE WITH FIGURES 9 AND 14.

FIG. 12.* A GROUP-I CONTROL. THE CERVICAL SYMPATHETIC GANGLIA ARE INTACT, BUT MUELLER'S MUSCLE HAD BEEN REMOVED FROM THE RIGHT ORBIT. NOTE THE DIFFERENCE IN PROTRUSION CAUSED BY THIS OPERATION.

FIG. 13.* A CONTROL OF GROUP II. MUELLER'S ORBITAL MUSCLE AND THE CERVICAL SYMPATHETIC GANGLION HAD BEEN REMOVED ON THE RIGHT SIDE. THE LEFT EYE IS NORMAL

FIG. 14.* A CONTROL OF GROUP III. THE CERVICAL SYMPATHETIC GANGLIA HAVE BEEN REMOVED ON BOTH SIDES AND MUELLER'S MUSCLE FROM THE RIGHT ORBIT. NOTE THE DIFFERENCE IN PROTRUSION BETWEEN THE RIGHT AND LEFT EYES. THE UVEAL TRACT OF THIS ANIMAL IS PIGMENTED.

* Figures 9 to 16 are of control and exophthalmic guinea pigs photographed *post mortem* after removal of the skin and lids in order to demonstrate the relation of the bulb to the skull and orbit.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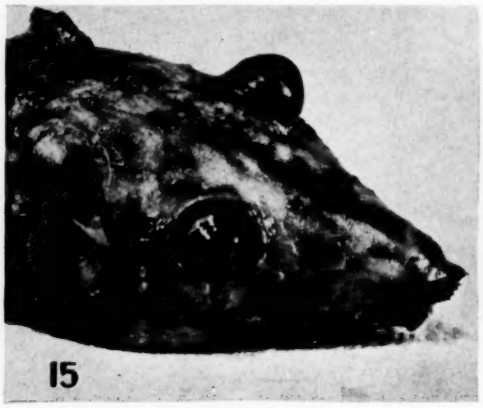
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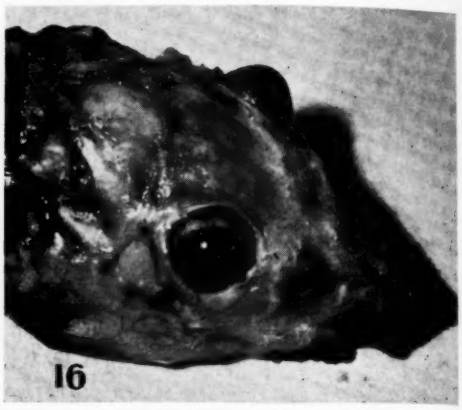
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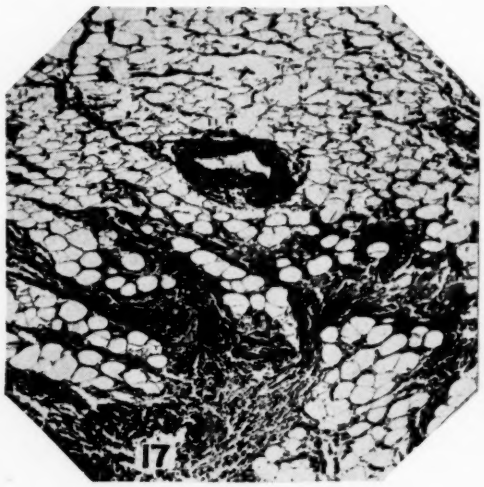
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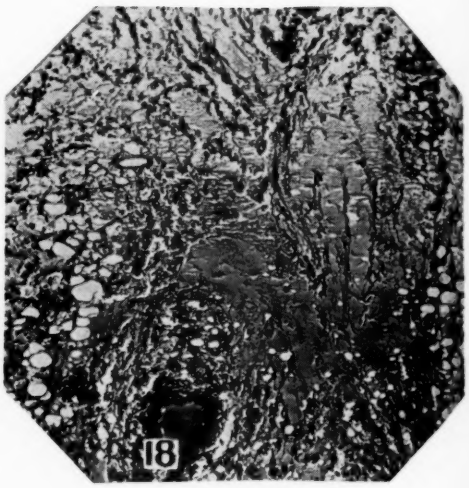
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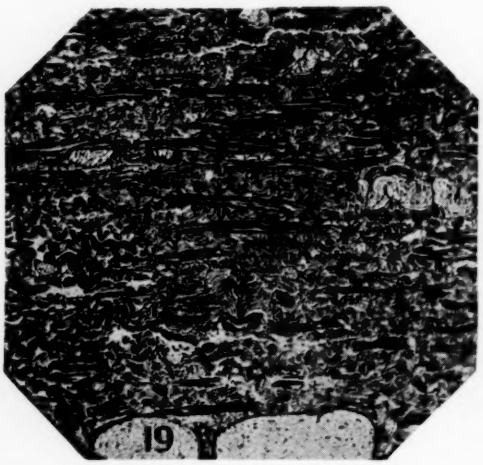
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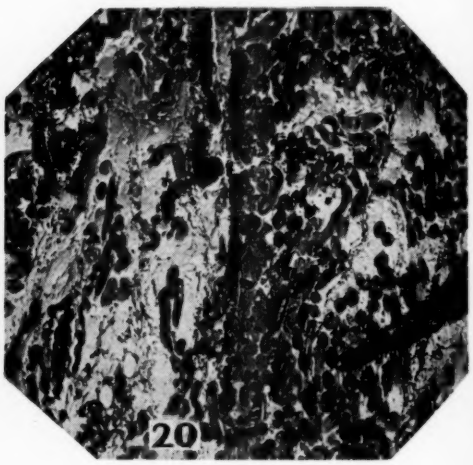
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ated on, in both the experimental and control series. Careful search for remnants of the sheet of smooth muscle was made in each case.

In all three groups of the injected animals the orbital contents were increased in weight. The hypertrophy of the orbital contents (table 1) was not affected by removal of the cervical sympathetic ganglia. In the left eyes of groups II (normally innervated eyes) and III (sympathetics removed), where the closest comparison can be made, the orbital-tissue hypertrophy was 28 and 31 percent, respectively.

Removal of Müller's orbital muscle did not affect the hypertrophy of the retrobulbar tissue; indeed, in all three groups the orbits that had been operated on were the heaviest. Furthermore, extirpation of the cervical sympathetic ganglia in addition to the removal of Müller's muscle did not inhibit the increase in orbital contents. Comparison of the tissue weights of the right orbits of groups I (innervations intact, Müller's muscle removed) and III (sympathetic innervation and Müller's muscle removed) revealed an increase of 28 and 30 percent, respectively.

As reported in earlier experiments, all of the orbital tissues were involved in the hypertrophy excepting the ventral lacrimal gland. The more dorsal lacrimal (Harderian gland) did become hypertrophied and was of great importance in these experiments because of its large size. The orbital fat and connective tissue, however, underwent the greatest relative increase. The extraocular muscles were highly consistent both in the control weights and in the degree of hypertrophy.

Histology

In general the histological structure of the orbital fat was, with but one noteworthy difference, as described in earlier reports (Smelser[8, 13, 22]). In the operated-on orbits of both controls and injected animals more than the usual amount of connective tissue was noted. In the orbital fat of two of the controls some edema was found in amounts larger than is usually seen. It may be that some inflammatory reaction following removal of Müller's orbital muscle was responsible in these two instances. The fat tissue of the exophthalmic animals showed marked infiltration of an edematous material that penetrated into the loose connective tissue and among the fat cells (fig. 18). The condition was found to exist in tissue from animals from which the cervical sympathetic ganglia had been removed bilaterally and in orbits lacking Müller's orbital muscle.

Sections of the extraocular muscles revealed a condition similar to that noted in the examination of orbital fat. Muscles of both controls and exophthalmic animals contained in some cases more than the normal amount of connective tissue.

PLATE 6 (SMELSER).

FIG. 15.* A PROFILE VIEW OF AN EXOPHTHALMIC GUINEA PIG OF GROUP III TO SHOW THE DEGREE OF PROTRUSION OF THE EYE. THE CERVICAL SYMPATHETIC GANGLIA HAVE BEEN REMOVED BILATERALLY. MUELLER'S MUSCLE HAD BEEN REMOVED FROM THE RIGHT. BUT IS INTACT IN THE LEFT ORBIT. COMPARE WITH FIGURE 16.

FIG. 16.* A PROFILE VIEW OF A CONTROL GUINEA PIG OF GROUP III. THE CERVICAL SYMPATHETIC GANGLIA HAVE BEEN REMOVED BILATERALLY. MUELLER'S MUSCLE HAD BEEN REMOVED FROM THE RIGHT SIDE. BUT IS INTACT IN THE LEFT ORBIT.

FIG. 17. PHOTOMICROGRAPH OF ORBITAL FAT FROM THE RIGHT ORBIT OF AN UNINJECTED CONTROL GUINEA PIG OF GROUP III.

FIG. 18. ORBITAL FAT FROM A GROUP-III EXOPTHALMIC GUINEA PIG. THIS SPECIMEN WAS REMOVED FROM AN ORBIT DEPRIVED OF BOTH MUELLER'S MUSCLE AND SYMPATHETIC INNERVATION THROUGH THE CERVICAL GANGLIA. NOTE THE LARGE AMOUNT OF EDEMATOUS INFILTRATE.

FIG. 19. EXTRAOCULAR MUSCLE FROM THE RIGHT ORBIT OF AN UNINJECTED GROUP-III CONTROL GUINEA PIG.

FIG 20. AN EXTRAOCULAR MUSCLE FROM AN EXOPHTHALMIC GUINEA PIG OF GROUP III. NOTE THE EXTENSIVE INVASION OF THE TISSUE BY A LIGHTLY STAINING EDEMATOUS INFILTRATE. THE MUELLER'S MUSCLE OF THIS ORBIT AND BOTH CERVICAL SYMPATHETIC GANGLIA HAD BEEN REMOVED.

TABLE 1

THE EFFECT OF ANTERIOR-PITUITARY-EXTRACT INJECTIONS ON THE WEIGHT OF RETROBULBAR TISSUE IN ORBITS DEPRIVED OF MÜLLER'S MUSCLE AND/OR INNERVATION THROUGH THE CERVICAL SYMPATHETIC GANGLIA

Injected Series											
Group I Sympathetic Ganglia Intact				Group II Right Sympathetic Ganglion Out				Group III Both Sympathetic Ganglia Out			
Animal Number	Body Wt. gm.	Total Weight of Retrobulbar Tissues, mg. O.D.	O.S.	Animal Number	Body Wt. gm.	Total Weight of Retrobulbar Tissues, mg. O.D.	O.S.	Animal Number	Body Wt. gm.	Total Weight of Retrobulbar Tissues, mg. O.D.	O.S.
663	450	983	885	650*?	430	938	949	566	460	1228	1216
665	490	1028	978	648	450	1007	918	527*	490	827	748
570	580	998	994	575	490	1077	1044	652	520	868	942
659	610	1095	950	579	520	1189	1119	651	530	734	820
562	615	1183	1161	576	535	1097	936	657	530	1046	928
543*	630	823	857	655*	555	874	750	567	550	1054	1003
661	635	1182	1048	577	570	1007	1011	654*?	565	959	911
660	645	1216	1134	573	630	1110	1099	653	625	1060	977
664	650	1094	1139	578	670	1274	1247	564	710	1272	1296
				647	695	1069	993				
9 cases Av.	589	1067	1016	10 cases	554	1064	1007	9 cases	553	1005	982
				Uninjected Control Series							
583	430	729	652	636	430	717	666	616	415	687	648
638	440	776	670	674	480	743	677	565	415	773	741
614	530	884	739	637	520	773	736	672	510	673	719
625	585	863	811	640	660	897	870	619	515	845	773
629	700	913	793	572	720	1088	996	671	540	698	684
612	770	847	778	639	740	877	788	621	615	787	803
								644	785	963	889
6 cases Av.	576	835	740	6 cases	591	839	789	7 cases	542	775	751

Müller's orbital muscle was removed from the right orbit in each case; the left orbit remained intact.

* No exophthalmos produced.

*? Questionable exophthalmos.

Usually only one or two muscles were affected. In the muscles of the exophthalmic series considerable amounts of an edematous infiltration were observed (fig. 20). This infiltration did not invade all parts of a muscle equally nor all muscles of an orbit. No modification of the cell structure of the muscle fibers was observed. These changes occurred in the right orbits of group III, which had been deprived of both cervical sympathetic ganglia as well as Müller's orbital muscle. Several animals of the injected series showed no infiltration in the sections studied. A few sections of control muscles contained much connective tissue accompanied by some infiltration similar to that found in exophthalmic animals and in the orbital fat of a few controls. The marked variation in the degree of edematous infiltration found in these muscles is in keeping with earlier reports and the condition found in clinical cases of postthyroidectomy exophthalmos.[13]

The width of the palpebral fissure of the animals of the three groups varied greatly, depending upon the operative treatment or injections. Extirpation of both the cervical sympathetic ganglia or of Müller's muscle produced a nar-

rowed fissure, whereas exophthalmos was accompanied by a widened one. In an attempt to express these changes quantitatively it was found that, although the differences were small, repeated measurements agreed remarkably well. Measurements were made with a vernier caliper at the same time each day and under constant illumination. Measurements on individual animals were repeated each day until several consistent consecutive values were obtained, both before and after injection of the anterior-pituitary extract. The increase in width of the palpebral fissure during the experimental periods represents the changes induced by the extract and those caused by growth during a period of 45 days. Extirpation of the cervical sympathetic ganglia reduced the palpebral fissure from the normal 7.7 to 8.0 mm. (fig. 2) to an average of 5.7 mm. (fig. 4), table 2. Removal of Müller's orbital muscle from a normally innervated orbit decreased the palpebral fissure to about the same extent, 6.0 mm. (fig. 3). If, however, both the muscle and ganglion were taken out the space between the lids became still less (4.8 to 5.1 mm., fig. 5), presumably due to relaxation of the smooth-muscle fibers of the lids.

Production of exophthalmos by anterior-pituitary-extract injections caused a widening of the palpebral fissures in all three groups which, relative to their original width, was of about the same degree in each. In group I the proportional widening of the lid fissure was the same in both eyes although one was normal and the other lacked Müller's orbital muscle. In the eyes lacking sympathetic innervation a similar increase in palpebral-fissure width took place in the eyes in both series (those operated on and those unoperated on). In these instances the increase was even greater, relatively, than that occurring in normally innervated eyes.

TABLE 2

THE EFFECT OF ANTERIOR-PITUITARY-EXTRACT INJECTIONS ON THE AVERAGE WIDTH OF THE PALPEBRAL FISSURE OF GUINEA PIGS IN (1) NORMALS, FOLLOWING REMOVAL OF (2) THE CERVICAL SYMPATHETIC GANGLIA (3) MÜLLER'S ORBITAL MUSCLE OR (4) BOTH MÜLLER'S MUSCLE AND THE CERVICAL SYMPATHETIC GANGLION

	Right Eye Müller's Orbital Muscle Removed		Left Eye Orbit Intact	
	Before Injections	After Injections	Before Injections	After Injections
	Group I. Cervical Sympathetic Ganglia Intact			
7 cases	6.00 mm.	6.7 mm.	7.7 mm.	8.6 mm.
Min.-Max.	5.6–6.5 mm.	6.3–7.5 mm.	7.0–8.3 mm.	8.3–9.0 mm.
	Group II. Right Cervical Sympathetic Ganglion Removed			
11 cases	4.8 mm.	5.8 mm.	7.8 mm.	8.7 mm.
Min.-Max.	4.0–5.7 mm.	4.5–7.5 mm.	7.0–8.5 mm.	7.5–9.5 mm.
	Group III. Both Cervical Sympathetic Ganglia Removed			
8 cases.	5.1 mm.	5.6 mm.	5.7 mm.	6.8 mm.
Min.-Max.	4.0–6.2 mm.	5.0–6.5 mm.	4.8–6.9 mm.	6.0–7.6 mm.

Discussion

Two methods have been suggested by which the action of Müller's orbital muscle might cause exophthalmos. One concept suggests that the contraction of the muscle fibers might check the flow of venous blood from the orbit and that this stasis might eventually lead to an edema of orbital structures.[21] The many intercommunicating channels by which the or-

bit could be drained and their distance from Müller's orbital muscle argue against this concept when applied to the human (Hesser[23]). In connection with the present experiments the jugular veins of several guinea pigs were injected with a warm carmine-gelatin mass. With this aid the veins of the head were clearly demonstrated in dissections. The pattern of the major venous channels of the face and orbit in the guinea pig was found to be identical with that in man. These channels anastomose freely and, excepting those draining into the cavernous sinus, are not involved with the sheet of smooth muscle. Even if all venous drainage through the posterior part of the orbit should be stopped, there are sufficient accessory channels to care for the orbit properly.

The data supplied by the present experiments finally dispose of this idea because the orbital-tissue changes occur after surgical removal of Müller's muscle. It does not seem probable, therefore, that this type of experimental exophthalmos in guinea pigs is caused by the action of Müller's muscle on the venous drainage channels.

The second, and more frequently considered, means by which Müller's muscle might act is by creating sufficient pressure on the retrobulbar tissue to push the globe outward. This is indeed possible, to some degree, but the persistence of exophthalmos *post mortem* and in the absence of Müller's muscle removes that possibility in these experiments.

The arguments against the importance of Müller's orbital muscle in clinical and experimental exophthalmos reported here do not indicate that the sympathetic nerves and smooth muscles of the eye are not involved in some cases of both clinical and experimental exophthalmos. It seems likely that in those clinical cases associated with hyperthyroidism, in which a heightened activity of the sympathetic nerves exists, contraction of the smooth muscles of the lids certainly would contribute to the appearance of exophthalmos by a widening of the palpebral fissure. Whether the action of such muscles could have any effect on the proptosis of the globe in humans has not been demonstrated. Certainly the experimental exophthalmos reported by Marine *et al.*, Code and Essex, Cannon and others, is of this functional type, brought about by sympathetic stimulation and action of both Müller's orbital and the palpebral muscles.

Extirpation of the cervical sympathetic ganglia in clinical cases of exophthalmos has not generally led to a decrease in the protrusion. A similar situation was found in the present experiments when removal of these ganglia on one or both sides, with or without the orbital muscle, had no effect on the hypertrophy of orbital tissue or on the exophthalmos *post mortem*. Therefore, it seems clear that the active constituent of the pituitary extract does not act through the cervical sympathetics, on the sympathetic receptive substance, or on the smooth-muscle cells.

The apparent degree of exophthalmos is largely controlled by the position of the lids in guinea pigs. This is clearly shown by measurements of the palpebral fissures. In all these groups of experimental animals a marked ptosis had been produced by the removal of either Müller's muscle or the cervical sympathetic ganglia, or both, at the beginning of the experiment. Although these fissures widened as the injections were given, the ptosis concealed the protrusion of the globe to a large extent. In animals with a ptosis careful examination was necessary in order to decide if there was a real proptosis or not, yet at autopsy the exophthalmos was found to be definite, and the orbital contents were almost equally hypertrophied in all groups.

In these experiments removal of the

floor of the orbit (Müller's muscle) achieved a form of orbital decompression by giving the retrobulbar tissues a slightly greater space into which they could expand. This condition decreased the degree of protrusion to a slight extent, but the amount of orbital tissue was not decreased nor was the edemateous infiltration prevented. Furthermore the operative procedure stimulated the growth of connective tissue to a marked degree.

In general one may conclude from the foregoing experiments that the tissue hypertrophy, edematous infiltration, and exophthalmos (demonstrated *post mortem*) produced in this manner is independent of sympathetic innervation through the cervical ganglia and of Müller's orbital muscle. In these characteristics this type of exophthalmos is similar to postthyroidectomy, progressive, or malignant exophthalmos in man.

Conclusions

1. The hypertrophy and pathological modification of the retrobulbar tissue found in exophthalmos produced by injection of anterior-pituitary extract into thyroidectomized guinea pigs is independent of Müller's orbital muscle.

2. These changes are unaffected by unilateral or bilateral extirpation of the cervical sympathetic ganglia.

3. The ptosis created by sectioning the cervical sympathetic ganglia or removing Müller's muscle decreases the apparent degree of exophthalmos.

4. Exophthalmos produced as described, and judged *post mortem* after removal of the skin and lids, is not dependent either upon Müller's orbital muscle or sympathetic innervation through the cervical ganglia.

5. Orbital decompression, as achieved in these experiments, does not relieve the condition of the orbital tissues, but slightly decreases the degree of proptosis.

I wish to express my appreciation to Miss Victoria Ozanics for her able assistance throughout this study.

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THE ROLE OF BRUCELLA IN HUMAN AND ANIMAL OCULAR DISEASE WITH SPECIAL REFERENCE TO PERIODIC OPHTHALMIA IN HORSES*

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Periodic ophthalmia or "moonblindness" in horses is a recurring uveitis which usually leads to complete loss of vision through cataract formation or massive detachment of the retina. The etiology is obscure. However, certain recent, personal clinical and experimental observations suggest that the disease may be a manifestation of Brucellosis. Although a considerable body of information relative to Brucella infections has been assembled, the suggestion that periodic ophthalmia is a form of this disease, to our knowledge, is apparently new, and it is the purpose of this report to present such information as is pertinent to this hypothesis and also to discuss briefly the relation of these findings to human ophthalmological problems.

Brucella infections derive their name from David Bruce,[1] an English army physician who, in 1887, isolated a small gram-negative, coccoid bacillus from patients with Malta or Mediterranean fever. In 1897, Bang[2] recovered the organism from cows that aborted their young. In 1913, Traum[3] grew it from sows that had aborted. Human infection due to this organism was rarely recorded in this country until 1918, when Evans[4] suggested that the Bang type might be pathogenic for man. Since that time a steadily increasing number of infections in humans has been reported each year. Because of the increasing interest in the disease and the increasing confusion in terminology the proposal has been made and generally accepted that strains of this organism from any source be given the generic name of Brucella in honor of the man who first isolated the organism.

In horses, the organism has been recovered from rare cases of abortion and more commonly from a clinical condition known as fistulous withers or poll evil. In animals with this disease a fluctuant swelling develops at the site of some physical trauma such as about the shoulders following the use of poorly fitting collars. Ultimately, the abscess breaks down or is opened, and a chronic draining sinus is established. Brucella has been recovered in pure culture from such abscesses before rupture. Although it is commonly considered to be the cause of the condition, experimental inoculation has never directly reproduced the disease.

The study was undertaken for several reasons. First, the disease is of tremendous economic importance to the breeder and user of horses, and our interest was aroused by the owners of afflicted horses who asked for some therapeutic help; second, because periodic ophthalmia in horses resembles recurring uveitis in humans, the etiology of which is frequently obscure. This resemblance suggested that a study of the natural disease in the horse might yield information applicable to the human problem.

Periodic ophthalmia is a disease that is probably as old as the domesticated horse, but its recorded history is scanty, inaccurate, and colored with superstition.

* From the Wilmer Institute of Ophthalmology, Johns Hopkins University.

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This rather sweeping and condemnatory statement is based on 12 years of observation (E. L. B.), during which time it was found that most of the recorded facts and popular ideas could not be substantiated. Therefore, a review of the early literature would only be time-consuming. It can be summarized, however, by saying that the disease has been attributed to food, climate, elevation above sea level, miasms, filth, and parasites of one kind or another. More recently, in 1927, Rosenow[5] reported that Flavobacterium ophthalmiae was the cause of the disease. This was denied by Woods and Burky[6] in 1929. In the same year Woods and Chesney[7] announced that a filterable agent from the diseased eye, when injected into the vitreous of healthy horse eyes, produced a recurring uveitis that resembled periodic ophthalmia. The other eye, however, was never affected, and it was not shown that the disease could be transmitted by any other form of inoculation. Dimock[8] and his associates have been unable to confirm the findings of Woods and Chesney.

The disease occurs at any age except in the suckling foal, although the mother may have several attacks during lactation. It is the impression of one of us (E. L. B.) that the disease is much more common in females and geldings than in stallions. The ocular inflammation develops in an apparently normal eye within 24 to 48 hours, at which time the lids are markedly injected and edematous, with greatly increased lacrimation. Photophobia and lid spasm are so marked that examination may be almost impossible unless the animal is restrained. The cornea is hazy, and after a few days there is a marked vascular infiltration extending two to five millimeters from the limbus. The iris pattern is hazy, the pupil is small. The aqueous ray is so strongly positive that a fundus examination is often impossible. After a few days hypopyon develops. The fundus is usually obscured by a vitreous haze. In most animals the individual attack runs its course in 10 to 20 days, and during the early remissions between attacks the affected eye appears normal. Later, after repeated attacks, pigment deposits on the anterior lens capsule, posterior synechiae, lens opacities or complete cataracts are found. The attacks occur at irregular intervals and may shift to the opposite eye, or both eyes may be involved at the same time. Occasionally, early in the disease, detachment of the retina occurs. Curiously enough, such eyes have few recurrences. Histologically, the eyes show the usual picture of a chronic uveitis, the only peculiar finding being nodules of lymphocytes. It is not clear whether these are pathognomonic, for little is known about equine ocular reactions to disease.

Early in 1938 a two-year-old filly was seen with a typical periodic ophthalmia in the right eye. It was her third attack. While the ocular examination was in progress she had a profuse, yellow, mucoid discharge from the vagina or urethra, and it was a chance remark by the trainer concerning this discharge that led to these studies. In essence, the trainer reported that this filly had such a discharge whenever she came into heat, that the heat was prolonged for 10 to 15 days over the normal four or five, and that coincidentally the eye became inflamed. The animal was observed later in a subsequent attack with all of the above signs. It was then learned, although erroneously,* that the mare has as many heat periods as there are lunar cycles. This observation, in connection with the lay term "moon blindness," suggested that there might be some etiological relation-

* Twenty-one days is thought to be the cycle.

ship between the menstrual cycle and the ophthalmia. Examination of the animal by two veterinarians disclosed that she had a cystic ovary. However, the veterinarians disagreed on the significance of this finding. This animal was unfortunately not available for further study. In passing, it may be mentioned that cystic ovaries in the mare are not uncommon, and they are often artificially ruptured in animals that persistently fail to conceive. Pregnancy occurs often enough in such animals to justify the practice.

The owner of this animal* placed at our disposal two mares, aged 15 and 17 years, which developed periodic ophthalmia early in 1938 while the above-mentioned filly was under observation. Both of these developed the disease shortly after parturition, but the foals were normal and healthy. With the idea in mind that some etiological relationship existed between the genital tract and the ophthalmia, various studies were undertaken to establish an etiological agent in the ovaries or genital tract. There was one positive finding. Both animals had agglutinins for Brucella in serum dilutions as high as 1:320.

After the presence of agglutinins had been determined in the two animals above mentioned, one of them, Columbia II, was destroyed after she had weaned her foal. The postmortem examination was done under rather difficult conditions and was necessarily incomplete. However, a large cystic ovary was found, and from its contents and from the milk a strain of Brucella was isolated.

Shortly thereafter a blind gelding was destroyed. This animal had abscesses in the kidneys. Smears from the mucopurulent contents suggested the presence of Brucella, but cultures were negative.

The third animal was a three-year-old filly with bilateral retinal detachment. Other than that she had gone blind as a two-year-old, nothing was known of her history. She was destroyed by shooting. The postmortem examination showed cystic ovaries and a spleen that weighed 22 pounds. A strain of Brucella was recovered from the ovaries. The serum contained no agglutinins.

In February, the second mare, Prodigious, with the agglutinins for Brucella, foaled a healthy colt. A specimen of milk obtained two days after delivery showed numerous Brucella organisms.

The bacteriological isolation of organisms from other equine sources was interrupted by the death of Dr. Thompson, on February 21, 1939. Since that time the investigation has been continued by one of us (E. L. B.) following Dr. Thompson's technique with at first indifferent success. Two autopsies on affected horses were done without our finding any characteristic gross pathology and without isolating the organism.

Recently, however, a completely blind mare was destroyed. At autopsy there were found cystic ovaries, a slightly large and friable spleen, and a liver studded with tuberclelike nodules. A strain of Brucella was recovered from the cystic fluid and the blood. The serum did not contain any Brucella agglutinins, but the opsonocytophagic test on the whole blood was strongly positive.

In addition to these definite findings other suggestive but not conclusive observations have been made. First, one mare has been under observation through a number of attacks. Between attacks the animal has serum agglutinins present in dilution as high as 1:20. Shortly after the eye becomes involved in a recurrence the titer rises as high as 1:80.

Second, a farmer in Baltimore County brought two pregnant sows to his farm

* We are greatly indebted to Major G. L. Stryker for his material assistance and cooperation in this study.

from Pennsylvania, in 1938. Both aborted their young, and from a foetus, Brucella was recovered by the laboratories of the Maryland State Department of Agriculture. These same laboratories then examined the blood cells of all the animals on this farm without finding any Brucella agglutinins. Shortly thereafter, a mare developed her first attack of ophthalmia. She was first seen early this year after her third attack, and at that time the eyes were normal. Serum agglutinins were present in dilutions of 1:50. Two days after this examination the animal had a recurrence in both eyes. The agglutinins rose to 1:00.

This animal presented a clinical picture that does not seem to have been generally noted in periodic ophthalmia. At the time of the first examination, when the eyes were normal, the animal held its head high, did a good deal of prancing about, and was difficult to examine because of what might be termed "general good spirits." Two days later, after the ocular onset, the animal was dejected and listless, refused food and water, and was easily restrained for examination. The temperature had risen to 101°F. from 99°F. As the eyes cleared the temperature returned to 99°F. Other animals with periodic ophthalmia were then examined and similar temperature rises, suggestive of those seen in human Brucellosis, were observed. It is our impression that the majority of horses with inflamed eyes show evidence of a systemic as well as a local infection in the eyes.

Third, the following suggestive information was obtained on a farm, near Indianapolis, which raises hogs, cows, and Percheron horses. Periodic ophthalmia appeared in 12 mares out of a fluctuating population of about 70. These animals were pastured in a field that was watered by a stream which ran through a field occupied by a herd of hogs known to be infected with Brucella. It is interesting that not one of the 10 stallions has had any ocular disease. These are isolated, each with his own exercise yard, and the water supply is derived from an artesion well supply system.

Laboratory studies

Materials and methods. In the foregoing observations various tests have been mentioned. Time will not permit a detailed description of these. Moreover, it is unnecessary because we have followed, with minor variations, procedures that are amply described by Huddleson[9] and others.

The strain recovered from Columbia II has been used to inoculate 30 rabbits and 12 guinea pigs. All inoculations were done with 24- or 48-hour hormone broth cultures. This is the only strain that has been used for inoculation purposes in this laboratory. Intraocular injections were done by introducing the material into the anterior chamber through a 25-gauge needle with the animal under cocaine anesthesia.

Experimental. Whole-broth culture was introduced into the anterior chamber of the right eyes and broth-culture filtrate (Berkefeld V) into the left eyes of six rabbits. Cultures of this filtrate showed that the organism passed the filter. All of the rabbits developed an early keratoiritis with conjunctivitis. Thereafter the clinical course was extremely variable. One animal had a rather severe early reaction in the right eye, with little in the left. Later on the left eye developed a marked inflammation while the opposite eye slowly healed. Two rabbits recovered without any permanent damage, except for slight pigment deposits on the anterior capsule. In the three remaining rabbits the left eye showed little early reaction and healed without permanent change. The right

eyes developed caseous corneas with coincident iritic involvement. One of these corneas has remained caseous for five months while the others have only corneal opacities at the end of this time.

Eighteen rabbits have been injected in the right eye with whole culture. The same varying results were obtained. After three or four months some corneas were completely caseous, others healed with scar formation. Other eyes showed a low-grade iritis and closely resembled the clinical picture in horses. One animal developed a recurring keratitis in the opposite eye. Another rabbit, in which the anterior ocular lesions healed, showed an atrophic choroiditis.

Six rabbits were treated in the following way: Jequirity extract was instilled in the right conjunctival sac. This substance produces in the normal rabbit a kerato-conjunctivitis that clears up with no sequelae in about 10 days. One day after the instillation, 1 c.c. of a 24-hour broth culture was injected intravenously. Two of these rabbits developed a keratoconjunctivitis that persisted for more than six weeks until the death of one animal. The lesion in the remaining rabbit still persists. Two other rabbits developed a latticelike keratitis, associated with chalazionlike nodules in the conjunctivas. Ocular lesions did not develop in the two remaining rabbits although one died with definite Brucella lesions throughout the viscera. Several corneal opacities suggesting nummular keratitis have been seen.

Twelve guinea pigs were injected intraperitoneally or subcutaneously with broth culture. Each animal received 1 c.c. Three died within the month. The other nine were alive more than four months after inoculation and except for a possible weight loss seemed in good condition. Five of the 12 developed corneal opacities. One developed a keratoiritis that persisted for about two months, leaving a slightly hazy cornea, an irregular pupil, and posterior synechiae. Except for the absence of any gross lens opacities the eye is typical of those seen in horses after numerous attacks. Another pig developed, three months after inoculation, a unilateral kerato-iritis and conjunctivitis followed by an involvement of the second eye within a few days. Similar results were obtained by Fabyan[10] in 1912.

Of the 30 rabbits and 12 guinea pigs thus far infected, five rabbits and three pigs have died. Without exception these deaths have all occurred within 24 or 48 hours after the intracutaneous injection of Brucella filtrates. These injections were done to check the diagnostic value of cutaneous reactivity. Whether these deaths were due to a tuberculinlike sensitivity or to chance cannot be determined at this point.

From these results it is evident that the lesions produced in the eyes were extremely variable, nor can they be predicted. In this, the experimental lesions compare with those observed in man and other animals.

All of the experimental animals have been examined for agglutinins, opsonophagocytic indices and were found to be strongly positive. All showed cutaneous reactions to Brucella filtrates in varying degrees. The most positive reactions were found in animals with active ocular processes. In occasional animals, ocular lesions became more active following the cutaneous injections.

Postmortem examinations have shown a varying pathology. In some there were no gross lesions while in others the spleen was enlarged and studded with tuberclelike nodules. The picture in the liver varied. One rabbit showed a textbook picture of tularemia with the liver studded with nodules. The kidneys occa-

sionally showed the same nodules. Pneumonia was found, but this may have been due to secondary infection.

Little mention can be made of the histological picture in the eyes at this time, because it was thought not advisable to kill any of this small group with such a great diversity of clinical findings. Such eyes as have been examined do not present the histological picture of periodic ophthalmia.

Comment

The foregoing observations and experimental results show clearly that horses harbor bacteria of the Brucella group and that these organisms can cause ocular pathology in rabbits and guinea pigs. They do not prove, however, that periodic ophthalmia in horses is due to this organism, although the suggestion cannot be easily dismissed. Several obvious questions must be answered and the disease must be reproduced in horses by inoculation before any definite conclusions can be reached. However, with the above results and with what is already known about the disease in horses and other species some of the questions can be answered and an experimental approach can be planned.

Why have previous studies failed to disclose the presence of this organism? First, the organism is extremely difficult to grow from the infected animal and requires special media and technique and longer periods of incubation than are commonly used. The validity of many previous studies can be questioned on this point alone. Second, the organism is extremely difficult to recognize in histological preparations, so that its presence or absence could not be determined in stained sections of eyes. Third, the majority, if not all, of previous investigators have sought to recover and recognize the infectious agent in the diseased eye. That this recognition is a theoretical possibility there can be no doubt. In practice, however, it is almost an impossibility. Horses are expensive animals and owners are extremely loath to sacrifice animals without good cash returns before the recurrences and loss of vision have established the clinical diagnosis. Once this has occurred it becomes increasingly difficult to recognize the onset of a recurrence, and it is more than a probability that the organisms disappear rapidly from the eye after they have initiated an attack. Consequently, unless the eye is cultured early in an attack it is probable that nothing will be cultivated.

Has the disease been reproduced in horses? As yet no attempts have been made for a number of reasons. First, the experiments in rabbits and guinea pigs have shown that the ocular lesions vary with different animals. This observation, coupled with the distribution of the disease in horses, suggests that any well-planned experiment would include a large number of animals. For financial reasons alone such an experiment could not be undertaken at present.

It was mentioned earlier that although fistula of the withers is commonly thought to be due to Brucella, experimental inoculations have not reproduced the disease. This again suggests that some unknown factor must be under control before any experimental studies are undertaken.

Recent developments in the prevention of Bang's disease or infectious abortion in cattle suggest such a factor. Practical cattlemen have known and recent formal experiments in California have shown that the offspring of infected mothers, if they are born alive and healthy, are apparently immune to the disease and do not abort their young in adult life. While the explanation of this immunity is not definitely understood it seems likely that the ingestion of infected milk is a form of vaccination that is relatively harmless

to the newborn animal. If the same phenomenon should occur in horses it is obvious that the injection of animals, born of infected mothers, would be futile and only lead to false conclusions. Furthermore, it is just such animals that are likely to be available for experimental purposes because of the popular idea that the disease is hereditary and the young of infected mothers, consequently, can be bought more cheaply.

The idea that the disease is hereditary is open to question. Personal observations (E. L. B.), on the contrary, suggest that the opposite is true, that the young of infected mothers are immune. At the moment this impression is not open to statistical confirmation because no reliable figures are available. This much can be said, however: First, suckling foals do not develop the disease, and second, to the present time we have been unable to find an animal that has developed the disease in adult life after it has suckeled an infected mother. If this latter impression can be confirmed, it may lead to a practical method of control even though Brucella is not proved to be the cause of the disease.

Why is it that cattle known to be infected do not develop eye trouble? The easiest and most obvious answer to this question is that a difference in species reactivity is responsible. For example, two of the animals we have examined have been good brood mares and did not abort their foals, although they were definitely infected, whereas a cow with a similar infection would certainly have aborted at least one calf. However, certain indirect evidence exists that the eyes of cows are occasionally attacked by this organism, although in a somewhat different clinical form. DeSchweinitz[11] reported on papilledema and optic atrophy in Guernsey bulls. The histological evidence suggested that the lesions were due to a chronic blood-borne infection with some of the reactions of Bang's disease. One of the dairymen who owned some of the animals seen by deSchweinitz told E. L. B. that the blind ones had Bang's disease, that blindness is one of the stigmata in calves from infected mothers, and that the elimination of infected mothers eliminated the blindness in the herd.

These studies in the horse were undertaken in complete ignorance of the fact that ocular signs had been described in man and animals infected with Brucella. After our first experimental results had been obtained, the papers by Reed and Goldfain,[12] Green,[13] and McGinty and Gambrell[14] appeared, and suspicions that this species might cause human ocular reactions became more definite. This led to the study of the serological reactions to Brucella of individuals with uveal-tract and corneal inflammations in whom the etiological factor was obscure.

It was our intention, when this report was planned, to present the rather suggestive findings obtained in humans. However, the time limits imposed by this Society prevent adequate presentation and the human findings will be made the subject of a future report.

Summary

Brucella (species undetermined) has been recovered at necropsy from the ovaries and milk of three mares sacrificed because of blindness due to clinical periodic ophthalmia. A fourth strain has been recovered from the milk of a mare with a similar ocular condition.

When injected into the anterior chamber of rabbits or intravenously into rabbits and guinea pigs, the first strain that was recovered produced in some but not all animals ocular inflammation resembling periodic ophthalmia in horses and chronic recurrent intraocular inflammation in humans.

It is suggested that, because of the experimental results and clinical observations made in the field, infection with Brucella may be the cause, or one of the causes, of periodic ophthalmia. In addition, the experimental results, coupled with clinical observations on humans already reported in the literature, suggest that this infection may play an important role in human ocular pathology.

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Discussion

Dr. Clyde A. Clapp (Baltimore, Md.): I think probably Dr. Burky has told most of the details. It was a case of uveitis starting first in the left eye, followed in about six months by recurrence in the right eye. In spite of various diagnoses and in spite of anti-syphilitic treatment and in spite of tuberculin treatment, the eyes have gradually gone bad, vision entirely gone in the left eye and down to 2/200 in the right eye.

As Dr. Burky said, there have been various diagnoses on these eyes, and we are in hopes at the present time that the proper diagnosis has been made.

Dr. John Green (St. Louis, Mo.): The reason I speak is that I have a rather striking case which has still not been reported, which seems to indicate that the Brucella organism may be the cause of choroiditis, resembling clinically tuberculous choroiditis.

EXPERIMENTAL PRODUCTION OF CONJUNCTIVITIS WITH STAPHYLOCOCCI*

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Conjunctivitis has been produced in rabbits by several workers[1] using staphylococcus filtrates or toxin; however, the results with living staphylococci have not been so successful. Keratitis has been reported following the intracorneal inoculation of staphylococci and Strumia and Scarlett[2] have produced a keratoconjunctivitis by the intracorneal inoculation of staphylococci in rabbits previously sensitized by heat-killed organisms according to the technique of Julianelle.[3] However, conjunctival inoculations alone have failed.

The instillation of staphylococcus toxin upon the human conjunctiva likewise has resulted in a conjunctivitis, but there have been no extensive studies made with living staphylococci. McKee[4] reported the production of conjunctivitis in man by the instillation of staphylococcus cultures but gave no details.

Therefore this study was made in an effort to determine some of the factors entering into the production of conjunctivitis with staphylococci.

METHODS AND MATERIALS

Strains of Staphylococcus aureus used throughout the experiments were isolated from cases of conjunctivitis or keratoconjunctivitis. Each produced hemolysis upon blood-agar plates, fermented mannitol, liquefied gelatin, caused coagulation of citrated human plasma, and produced a potent exotoxin. Strain "B" was isolated from an acute conjunctivitis of a 6-day-old infant. Strain "M" was isolated from an adult with an acute ulcerative keratitis and conjunctivitis that had developed as an exacerbation of a chronic conjunctivitis. The strain of Staphylococcus albus used as a control was nonhemolytic, did not produce a measurable amount of exotoxin, did not ferment mannitol, and did not liquefy gelatin. It was isolated from the normal conjunctiva of a pre-operative cataract patient who had no postoperative infection.

In one series of rabbit inoculations and in one series of human inoculations, cultures were used that had been grown in nutrient broth for 18 hours at 37°C. In all other series the organisms were grown in nutrient broth for 3 hours. The medium was inoculated, placed in a 37°C. water bath, and shaken every 15 minutes.

Inoculations were made into the mouths of the meibomian glands of one series of rabbits. For this purpose a sterile Pasteur pipette was drawn out to capillary diameter, the tip broken off and a small amount of inoculum drawn into the pipette. Rabbits anesthetized by intravenous nembutal were placed under a dissecting microscope, the tip of the pipette was inserted into the mouth of a meibomian gland of the lower lid, and a small amount of the inoculum injected into the gland.

Anitoxin determinations were made by the hemolytic method,[5] and were controlled by standard toxin and antitoxin kindly furnished by the National Institute of Health.

RABBIT EXPERIMENTS

White rabbits weighing between 3 and

* From the Department of Ophthalmology, State University of Iowa, College of Medicine. Part of a study being conducted under a grant from the John and Mary R. Markle Foundation. Read before the Association for Research in Ophthalmology in Saint Louis, May 16, 1939.

TABLE 1
RABBIT: SERIES I

INOCULUM: O.D., 18-HOUR BROTH CULTURE OF STAPHYLOCOCCUS AUREUS; O.S., NO INOCULATION

No. of Rabbits	Condition of Conjunctiva	Method of Inoculation	Result	Staph. aureus Cultured from O.D.	Antitoxin per c.c. Serum
12	Normal	Instillation	No conjunctivitis	3–5 days	0
12	Abraded	Instillation	Traumatic reaction 24 hours' duration	3–5 days	0
12	Normal	Instillation of organisms suspended in toxin	Toxic reaction of 24 hours' duration	3–5 days	0

5 pounds were selected for the experiments, after examination revealed normal conjunctivae and cultures showed no pathogenic bacteria. In addition the serum of each rabbit was titrated and only those without demonstrable antitoxin were used.

Series I

Inoculations were made in 36 rabbits by the instillation of an 18-hour broth culture of Staphylococcus aureus into the conjunctiva of the right eye (table 1). The left eye served as a control in each case. In the first group of 12 rabbits the instillation was made upon the normal conjunctiva. Cultures were taken from both eyes each day for one week following the instillation. Staphylococcus aureus was grown from the right eye for 3 to 5 days, but there was no evidence of conjunctival irritation nor discharge. Staphylococcus aureus was not grown from the left (control) eye.

In the second group of 12 rabbits the cocainized conjunctiva of the right eye was abraded with a sterile platinum spatula before the instillation was made. Following this method of inoculation the conjunctiva was red and congested for approximately 24 hours. There was a slight amount of purulent discharge on the lid margin the morning after inoculation, but both the redness and discharge were absent after 30 to 36 hours. Cultures of the right eye grew Staphylococcus aureus for 3 to 5 days, but the uninoculated left eye remained free from these organisms.

In the third group of 12 rabbits the organisms were suspended in toxin and then instilled into the conjunctiva of the right eye. The 18-hour broth culture was centrifuged, the supernatant broth removed, and the organisms resuspended in toxin. In approximately 6 hours conjunctival injection developed, increased for several hours, and disappeared in from 18 to 24 hours after the inoculation. A slight purulent exudate accompanied the

TABLE 2
RABBIT: SERIES II

INOCULUM: O.D., 3-HOUR BROTH CULTURE; O.S., NO INOCULATION

No. of Rabbits	Condition of Conjunctiva	Method of Inoculation	Result	Staph. aureus Cultured from O.D.	Antitoxin per c.c. Serum
6	Normal	Instillation	No conjunctivitis	3–5 days	0
6	Abraded	Instillation	Traumatic reaction	3–5 days	0

redness and disappeared with it. Conjunctival cultures revealed Staphylococcus aureus in the right eye for 3 to 5 days, but no colonies of this organism were grown from the left eye.

Series II

Inoculations were made in 12 rabbits by the instillation of a 3-hour broth culture into the right conjunctival sac (table 2). In 6 the instillation was made upon the normal conjunctiva, and in 6 the instillation was made upon the abraded conjunctiva. The results were comparable to those from the inoculations in series I.

Series III

Inoculations were made into the meibomian glands of the left lower lids of 30 rabbits. In each case the right eye served as an uninoculated control.

The first group of 12 rabbits was inoculated with a 3-hour broth culture of Staphylococcus aureus. An acute infection of the meibomian gland and an acute conjunctivitis developed in approximately 12 to 18 hours. These infections reached their height in 48 hours (fig. 1), persisted for 2 to 3 weeks, then gradually subsided into a chronic meibomitis and conjunctivitis that lasted for 6 to 8 months. Cultures taken during the acute infection grew many colonies of Staphylococcus aureus. After the acute infection subsided cultures were taken at weekly intervals, and during the first month Staphylococcus aureus was grown in each culture. However, the number of colonies gradually diminished, and after two months Staphylococcus aureus could be cultured only from material expressed from the meibomian glands.

In a control group of 12 rabbits the inoculum was a 3-hour broth culture of Staphylococcus albus. In these animals an acute meibomian infection developed in approximately 12 to 18 hours, reached its height in 24 to 36 hours, and began to subside in 48 to 60 hours (fig. 2). Many colonies of Staphylococcus albus were obtained upon culture 24 hours after the inoculations, but the number diminished rapidly and the cultures from the two eyes were comparable again after 4 to 5 days.

A second control group consisted of 6 rabbits immunized by repeated intravenous injections of a potent toxoid.* Serum titers ranged from 40 to 60 units of antitoxin, one had 40 units, two had 44 units, one had 52 units, one 55 units, and one 60 units per cubic centimeter. The meibomian glands of these rabbits were inoculated with a 3-hour broth culture of Staphylococcus aureus. An acute localized infection of the meibomian gland developed and subsided in 48 to 72 hours. Cultures of Staphylococcus aureus were obtained from the conjunctiva of the left eye for 4 or 5 consecutive days after the inoculation.

Human inoculations

A series of human inoculations was considered only after the essayist had inoculated his own conjunctiva with larger numbers of organisms than were used subsequently. His serum titer for antitoxin was 0.8 unit per cubic centimeter. Strain "B" was massaged upon the left conjunctiva with a platinum loop. Four months later a 3-hour broth culture of strain "M" was instilled upon the right conjunctiva. In each case, after a 24-hour incubation period, a mild acute conjunctivitis developed and subsided spontaneously in the course of one week.

Infants 4 to 6 days old were chosen for the human inoculations for the following reasons: first, and most important, was the fact that the spontaneous disease in infants is of the acute catarrhal type, is

* Kindly furnished by the Lederle Laboratories.

FIG. 1 (ALLEN). RABBIT CONJUNCTIVA 48 HOURS AFTER INTRAMEIBOMIAN INOCULATION WITH A TOXIGENIC STRAIN OF STAPHYLOCOCCUS AUREUS.

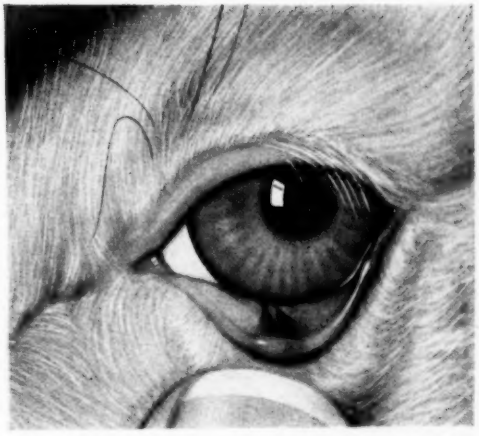

FIG. 2 (ALLEN). RABBIT CONJUNCTIVA 48 HOURS AFTER INTRAMEIBOMIAN INOCULATION WITH A NON TOXIGENIC STRAIN OF STAPHYLOCOCCUS ALBUS.

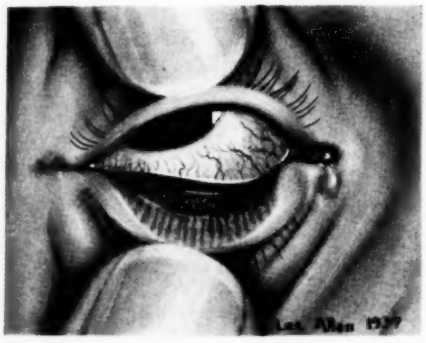

FIG. 3 (ALLEN). ANGULAR EXCORIATION, SLIGHT DISCHARGE, AND HYPEREMIA 60 HOURS AFTER INSTILLATION OF STRAIN "M" ONTO THE NORMAL CONJUNCTIVA.

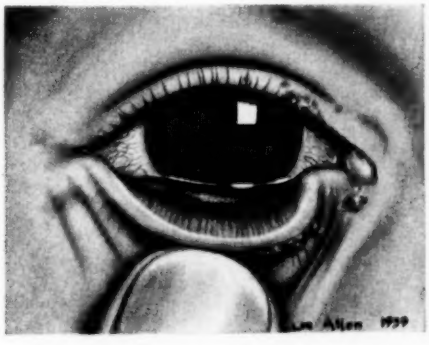

FIG. 4 (ALLEN). CONJUNCTIVITIS 72 HOURS AFTER INSTILLATION OF STRAIN "M" ONTO THE NORMAL CONJUNCTIVA.

TABLE 3
RABBIT: SERIES III
MEIBOMIAN-GLAND INOCULATIONS, LEFT EYE ONLY

No. of Rabbits	Inoculum (3-hour culture)	Result	Antitoxin per c.c. Serum
12	Staph. aureus (toxigenic)	Acute meib. and conj. 2–3 weeks' dur. Chr. meibomitis 6–8 mos.' duration	0
12	Staph. albus (nontoxigenic)	Meibomitis localized 48–72 hours' dur.	0
6	Staph. aureus (toxigenic)	Meibomitis localized 48–72 hours' dur.	40–60 u.

self-limited, and no serious sequelae are observed; second, variables such as contacts, exposures, and changes in temperature are more readily controlled, as the infants may be fed by bottle and kept in an isolated nursery; and third, the conjunctivae of infants are likely to be more nearly uniform. The individuals were selected on the basis of clinically normal conjunctivae and negative conjunctival cultures.

Series I

One drop of an 18-hour broth culture of Staphylococcus aureus (strain "B") was instilled into the right eye of each of five babies (table 4). Although Staphylococcus aureus was recovered on culture from these eyes for 4 or 5 days after the inoculation, no evidence of conjunctivitis was observed. In each case the antitoxin level of the serum was less than 0.1 unit.

Series II

A 3-hour broth culture of strain "B" was centrifuged, the supernatant broth removed, and the organisms resuspended in toxin previously prepared from the same strain. One drop of this suspension was instilled into the right eye of each of six infants (table 5). Conjunctival irritation became manifest by congestion and slight discharge in approximately 6 hours, increased for a few hours, and began to subside in 18 to 20 hours. In two infants the reaction continued to subside and disappeared completely between 24 and 30 hours. However, in four the reaction became more intense between 24 and 30 hours after the inoculation and persisted for 4 to 5 days, at which time local therapy was instituted. Cultures were made daily from both eyes of each baby. Many colonies of Staphylococcus aureus were grown each day from the right eyes but the left eyes remained free from this organism. The babies in whom the conjunctival reaction disappeared after 24 hours had an antitoxin titer of 1.0 unit per cubic centimeter of serum, the other

TABLE 4
HUMAN: SERIES I
INOCULUM: O.D., 18-HOUR BROTH CULTURE, STRAIN "B"; O.S., NO INOCULATION

Baby	Age in Days	Condition of Conjunctiva	Culture		Result	Antitoxin per c.c. Serum
			Before Inoculation	After Inoculation		
G. H.	5	Normal	Staph. alb. (NH)	Staph. aureus	No conj.	−0.1 unit
B. S.	5	Normal	No growth	Staph. aureus	No conj.	−0.1 unit
G. R.	4	Normal	Staph. alb. (NH)	Staph. aureus	No conj.	−0.1 unit
C. G.	9	Normal	No growth	Staph. aureus	No conj.	−0.1 unit
G. T.	6	Normal	No growth	Staph. aureus	No conj.	−0.1 unit

(NH) = no hemolysis on blood agar.

TABLE 5
HUMAN: SERIES II

INOCULUM: O.D., 3-HOUR BROTH CULTURE, STRAIN "B", SUSPENDED IN TOXIN; O.S., NO INOCULATION

Baby	Age in Days	Conjunctivitis*	Incubation Period	Culture after Inoculation		Antitoxin per c.c. Serum
				O.D.	O.S.	
G. A. H.	4	+	24 hours	Staph. aureus	0	−0.06 unit
B. B. S.	5	+	24 hours	Staph. aureus	0	−0.06 unit
B. L.	5	0	—	Staph. aureus	0	1.00 unit
B. W.	4	+	24 hours	Staph. aureus	0	−0.06 unit
McF.	5	0	—	Staph. aureus	0	1.00 unit
B. H.	4	+	36 hours	Staph. aureus	0	0.12 unit

* Transient reaction to toxin in each case.

four had less than 0.2 unit per cubic centimeter.

Series III

In six infants one drop of a 3-hour broth culture was instilled upon the abraded conjunctiva of the right eye (table 6). The trauma was made with a sterile platinum spatula in the manner of taking conjunctival scrapings. The left eye was not inoculated. The mild traumatic reaction subsided in 12 to 18 hours in each case. In one baby no other conjunctival signs developed, but in five an acute catarrhal type of conjunctivitis appeared in from 24 to 36 hours and persisted for 4 to 5 days.

Cultures taken daily grew many colonies of Staphylococcus aureus from the right eye of each infant but none from the left eye.

The antitoxin titer of the serum was 0.2 unit or less per cubic centimeter for each of the five babies who developed conjunctivitis but was 0.6 unit per cubic centimeter for the one failing to develop an inflammation.

Series IV

A 3-hour broth culture of Staphylococcus aureus (strain "B") was instilled into the right conjunctival sacs of six infants. The left eyes were not inoculated (table 7). In five of the babies discharge and redness of the right conjunctiva was observed between 48 and 60 hours later. A typical acute conjunctivitis developed and persisted until local therapy was instituted 6 to 7 days after the inoculation. One baby did not develop signs of conjunctivitis. The serum titer in this case was 1.0 unit per cubic centimeter, whereas the sera of the five babies developing conjunctivitis contained 0.2 unit or less.

TABLE 6
HUMAN: SERIES III

INOCULUM: O.D., 3-HOUR BROTH CULTURE, STRAIN "B", ABRADED CONJUNCTIVA; O.S., NO INOCULATION

Baby	Age in Days	Conjunctivitis*	Incubation Period	Culture after Inoculation		Antitoxin per c.c. Serum
				O.D.	O.S.	
P. H.	6	+	24 hours	Staph. aureus	0	−0.1 unit
B. B.	5	+	36 hours	Staph. aureus	0	0.2 unit
G. A. W.	5	+	24 hours	Staph. aureus	0	−0.1 unit
W. I. E.	4	+	30 hours	Staph. aureus	0	0.2 unit
H. O. D.	4	0	—	Staph. aureus	0	0.6 unit
G. R. A.	4	+	30 hours	Staph. aureus	0	0.2 unit

* Traumatic reaction in each case.

TABLE 7
HUMAN: SERIES IV
INOCULUM: O.D., 3-HOUR BROTH CULTURE, STRAIN "B"; O.S. NO INOCULATION

Baby	Age in Days	Conjunctivitis	Incubation Period	Culture after Inoculation		Antitoxin per c.c. Serum
				O.D.	O.S.	
B. A. S.	5	+	48 hours	Staph. aureus	0	−0.1 unit
B. M.	4	0	—	Staph. aureus	0	1.0 unit
B. H.	4	+	48 hours	Staph. aureus	0	−0.2 unit
B. E. L.	5	+	60 hours	Staph. aureus	0	0.2 unit
C. R. A.	4	+	48 hours	Staph. aureus	0	0.15 unit
H. I. N.	4	+	48 hours	Staph. aureus	0	0.15 unit

Cultures made daily, after the inoculation, grew many colonies of Staphylococcus aureus from the right eye of each baby.

Series V

A 3-hour broth culture of Staphylococcus aureus (strain "M") was centrifuged, the broth removed, and the organisms resuspended in toxin previously prepared from the same strain. One drop of this suspension was instilled into the right eye of each of six infants (table 8). In each case a toxic conjunctivitis developed and subsided in 18 to 20 hours. In four infants no other manifestations of conjunctivitis was observed but in two conjunctival congestion and discharge reappeared approximately 24 hours after the instillation and persisted for 4 to 6 days.

The left eye of each infant of this series was inoculated by the instillation of one drop of a 3-hour broth culture of strain "M." In four infants no conjunctival irritation nor discharge developed. In two babies redness and discharge appeared between 48 and 60 hours after the inoculation but subsided spontaneously in 4 to 6 days.

Cultures were made daily, and colonies of Staphylococcus aureus were grown from each eye for 4 to 5 days. The antitoxin titer of the serum of the two infants who developed conjunctivitis was less than 0.1 unit but the titer of those who did not develop conjunctivitis varied from 1.0 to 10.0 units per cubic centimeter.

Series VI

The conjunctiva of the right eye of each of five infants was abraded with a sterile platinum spatula in the manner of taking a conjunctival scraping. One drop

TABLE 8
HUMAN: SERIES V
INOCULUM: O.D., 3-HOUR BROTH CULTURE, STRAIN "M", SUSPENDED IN TOXIN; O.S., 3-HOUR BROTH CULTURE, STRAIN "M"

Baby	Age in Days	Conjunctivitis		Incubation Period		Culture after Inoculation		Antitoxin per c.c. Serum
		O.D.*	O.S.	O.D.	O.S.	O.D.	O.S.	
G. F.	4	0	0	—	—	Staph. aur.	Staph. aur.	5.0 unit
B. B. B.	5	+	+	24 hours	60 hours	Staph. aur.	Staph. aur.	−0.04 unit
B. G. S.	5	0	0	—	—	Staph. aur.	Staph. aur.	10.0 unit
R. E. B.	6	+	+	24 hours	48 hours	Staph. aur.	Staph. aur.	0.03 unit
K. N. B.	6	0	0	—	—	Staph. aur.	Staph. aur.	1.2 unit
B. L. H.	6	0	0	—	—	Staph. aur.	Staph. aur.	1.0 unit

* Transient reaction to toxin in O.D. of each case.

TABLE 9
HUMAN: SERIES VI

INOCULUM: O.D., 3-HOUR BROTH CULTURE, STRAIN "M", ON ABRADED CONJUNCTIVA; O.S., 3-HOUR BROTH CULTURE, STRAIN "M"

Baby	Age in Days	Conjunctivitis		Incubation Period		Culture after Inoculation		Antitoxin per c.c. Serum
		O.D.	O.S.	O.D.	O.S.	O.D.	O.S.	
B. K.	5	+	+	24 hours	48 hours	Staph. aur.	Staph. aur.	−0.05 unit
B. B. A.	5	+	+	24 hours	48 hours	Staph. aur.	Staph. aur.	−0.05 unit
A. B.	5	+	+	30 hours	60 hours	Staph. aur.	Staph. aur.	−0.05 unit
B. E. A.	5	+	+	30 hours	60 hours	Staph. aur.	Staph. aur.	−0.10 unit
D. E. T.	4	+	+	24 hours	48 hours	Staph. aur.	Staph. aur.	−0.10 unit

of a 3-hour broth culture of strain "M" was instilled into both conjunctival sacs of the babies (table 9). In each case the traumatic reaction subsided in 12 to 18 hours, but conjunctival congestion accompanied by a slight discharge reappeared in the right eyes between 24 to 30 hours after the inoculations. Similar signs appeared in the left eye 24 to 30 hours later; that is, in 48 to 60 hours after the inoculations. The conjunctivitis persisted until controlled by local therapy six days after the inoculations. During this period many colonies of Staphylococcus aureus were grown daily from each eye. The antitoxin titer of the sera of these babies was less than 0.1 unit per cubic centimeter in each case.

Series VII

The right eye of each of six infants was inoculated by the instillation of one drop of a 3-hour broth culture of Staphylococcus aureus strain "M." The left eye of each was inoculated by the instillation of one drop of a 3-hour broth culture of Staphylococcus albus (table 10). In five cases a conjunctivitis developed in the right eye in from 48 to 60 hours after the instillations (figs. 3 and 4). No evidence of conjunctival inflammation developed in the left eyes, and in one case neither eye developed inflammation. In the latter instance the antitoxin titer of the baby's serum was 1.25 units per cubic centimeter. The titer of the sera of the five who developed conjunctivitis was less than 0.2 unit per cubic centimeter.

SUMMARY AND DISCUSSION

An infectious conjunctivitis was not produced in young rabbits by the instillation of cultures of toxigenic Staphylococcus aureus upon the normal or abraded

TABLE 10
HUMAN: SERIES VII

INOCULUM: O.D., 3-HOUR BROTH CULTURE, STRAIN "M"; O.S., 3-HOUR BROTH CULTURE, STAPH. ALBUS (NONHEMOLYTIC)

Baby	Age in Days	Conjunctivitis		Incubation Period		Culture after Inoculation		Antitoxin per c.c. Serum
		O.D.	O.S.	O.D.	O.S.	O.D.	O.S.	
C. L. S.	5	0	0	—	—	Staph. aur.	Staph. alb.	1.25 unit
H. A. R.	6	+	0	48 hours	—	Staph. aur.	Staph. alb.	−0.10 unit
H. S. K.	5	+	0	60 hours	—	Staph. aur.	Staph. alb.	0.2 unit
H. A. Y.	6	+	0	60 hours	—	Staph. aur.	Staph. alb.	−0.1 unit
S. T. K.	6	+	0	48 hours	—	Staph. aur.	Staph. alb.	−0.1 unit
B. G. C.	5	+	0	48 hours	—	Staph. aur.	Staph. alb.	0.2 unit

conjunctiva nor by the simultaneous instillation of organisms and toxin. However, an acute infectious conjunctivitis was produced in nonimmune rabbits following inoculation of the meibomian glands with a small amount of broth culture of a toxin-producing strain of Staphylococcus aureus. Nonimmune control rabbits inoculated in the same manner with a nontoxigenic strain of Staphylococcus albus developed a localized meibomian gland infection without conjunctivitis. Control rabbits with a high antitoxin level developed a similar localized meibomian gland infection without conjunctivitis after intrameibomian inoculation with the toxigenic strain of Staphylococcus aureus.

As has been shown by previous workers,[6] the normal or slightly traumatized conjunctiva of the rabbit was resistant to staphylococcus infection. However, with an infection established in the meibomian glands, apparently enough toxin was liberated to permit the production of a conjunctivitis. The proof of this reasoning lies in the abatement of the acute conjunctivitis simultaneouly with the acute meibomitis, the failure of the nontoxigenic strains of Staphylococcus albus to produce conjunctivitis, and the failure of the toxigenic strain of Staphylococcus aureus to produce conjunctivitis in the rabbits with high levels of antitoxin.

In the infants, toxin and antitoxin apparently were the important factors in the production of conjunctivitis with staphylococci. However, the age of the culture played some role, for 18-hour broth cultures failed to produce conjunctivitis even though the babies had less than 0.1 unit of antitoxin per cubic centimeter of serum. With 3-hour cultures toxigenic strains of Staphylococcus aureus, conjunctivitis was produced in each case in which the baby had 0.2 unit or less of antitoxin per cubic centimeter of serum, but conjunctivitis was not produced in infants with more than 0.5 unit of antitoxin per cubic centimeter. Conjunctivitis was not produced in babies with a nontoxigenic strain of Staphylococcus albus, even though the antitoxin titer was low.

Conjunctivitis appeared in 48 to 60 hours after the instillation of the culture upon the normal infant conjunctiva but this period was shortened by trauma. Both mechanical and toxic trauma reduced the incubation period to 24 to 30 hours. However, clinical application of these incubation periods should not be made because of the relatively large number of organisms instilled upon the conjunctiva in one drop of culture, perhaps 45 to 50 million.

Each infant was observed until the conjunctiva had returned to normal and cultures failed to grow the inoculated organisms. In a few cases the conjunctivitis subsided spontaneously after 4 to 5 days, in others the conjunctivitis was controlled by local therapy. No complications nor sequelae resulted.

The antitoxin level of the infant's serum was either equal to or slightly below that of its mother.

Conclusions

1. Toxigenic strains of staphylococci were capable of producing conjunctivitis when instilled onto the normal human conjunctiva.

2. Conjunctivitis did not develop in infants whose antitoxin titer was more than 0.5 unit per cubic centimeter of serum.

3. Trauma, either mechanical or toxic, shortened the incubation period of the experimental conjunctivitis in infants.

4. A nontoxigenic strain of Staphylococcus albus did not produce conjunctivitis in infants.

5. Conjunctivitis was not produced in rabbits by instillations of staphylococci

upon the normal or abraded conjunctiva or when instilled simultaneously with toxin.

6. In nonimmune rabbits intrameibomian inoculations of toxigenic strains of staphylococci produced an acute meibomitis and conjunctivitis of 2 to 3 weeks' duration followed by a chronic meibomitis and conjunctivitis of 6 to 8 months' duration.

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A STUDY OF THE PROFESSIONS TESTING OCULAR REFRACTION*

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This investigation has been carried out in an effort to determine and present certain facts concerning the professions of ophthalmology and optometry and to present impartially the results of such investigation.

Technically, an ophthalmologist or oculist is a graduate of a recognized college of medicine who has had special training in diagnosis and treatment of ocular diseases and refractive errors of the eye; an optometrist is one who measures the degree of visual acuity, a refractionist—referring generally to a person without medical training who fits glasses to correct visual defects.

PROCEDURE

The procedure followed in this investigation included the recording of the ocular history, the external examination of the eyes, and the examination of visual acuity by the Snellen Vision Chart upon entrance to the University of Illinois. Since this method is admittedly an incomplete test for visual defects, the author recognizes that many cases of muscle imbalance and other eye disorders are present among the student body that cannot be determined by this type of examination. The following information was obtained from the student:

Name and address of person from whom the student obtained examination for glasses; whether that person was a physician or an optometrist. The date when glasses were first obtained. The date of the last ocular examination. Whether the lenses were changed, and what symptoms of eyestrain, if any, were present with glasses.

At a later date the student's vision was rechecked.

The physicians' names were checked in the American Medical Association Directory to determine whether they were practicing medicine, or ophthalmology, or ophthalmology and otolaryngology. The departments of education and registration for licensing optometrists were contacted, and information regarding the requirements for the practice of optometry from the various states was obtained.

RESULTS

In order that the results of this investigation might be as accurate as possible, the students' records were classified into groups according to the time at which their glasses were obtained.

I. Those whose vision was not normal with glasses; examined within the last year by oculist or optometrist.
II. Those with marked and rapid progressive changes.
III. Those having incorrect vision with glasses; not examined within the last year.
IV. Total number of students with incorrect vision.

It will be seen in table 1, that 62, or 19.8 percent of 313 students examined by the oculist within the last year had subnormal vision. Since 41 had marked change in visual acuity, and, allowing for this progressiveness after the examination by the oculist, there remained 21 with uncorrected vision, or 6.7 percent. Of the 248 with defective vision examined by the optometrists within the last year, 100, or 40.3 percent had subnormal vision with glasses. With the markedly progressive cases deducted, there still remained 32.3 percent who had

*From the University of Illinois Health Service.

TABLE 1

COMPARATIVE STUDY OF REFRACTIONS DONE BY OCULIST AND OPTOMETRIST

	Oculist			Optometrist		
	No. students checked with glasses	No. with defective vis. with glasses	Percent students with improper correction	No. students checked with glasses	No. with defective vis. with glasses	Percent students with improper correction
Upperclassmen						
Examined within past year	313	62	19.8	248	100	40.3
Marked change in visual acuity within last year with present glasses not correcting same		41	13.		20	8.
Incorrect vision with glasses with marked visual change deducted		21	6.7		80	32.3
Examined previous to last year	214	48	22.4	191	76	39.8
Total examined	527	110	20.8	439	176	40.
New Students and Freshmen						
Examined within past year	164	21	12.5	163	61	37.
Examined previous to last year	44	9	20.4	79	21	26.5
Total examined	208	30	14.4	242	82	33.8
GRAND TOTAL EXAMINED	735	140	19.0	681	258	37.8

defective vision with glasses. Of the students wearing glasses which had not been rechecked within the past year, 22.4 percent examined by the oculist and 39.8 percent examined by the optometrist had defective vision. Considering the entire group of upperclassmen, and including all defects, 20.8 percent of those refracted by the oculist and 40 percent of those refracted by the optometrist had defective vision at the time of this investigation. Among the entire group of 1416 students, including all eye defects, 19 percent examined by the oculist had improper correction, whereas 37.8 percent examined by the optometrist had subnormal vision with glasses.

A comparison of the symptoms of students who wore glasses and were examined by each profession is given in table 2. Of those refracted by the oculist 5.2 percent had one or more symptoms, as compared to 16.3 percent with symptoms who were examined by the optometrist. Those students with symptoms, whose visual acuity had changed since the last examination by the oculist or optometrist, were not included. This leaves only 1.9 percent of the students refracted by the oculist with symptoms in contrast to 11.1 percent of those with glasses obtained from the optometrist.

TABLE 2

A COMPARATIVE STUDY OF THE OCULIST AND OPTOMETRIST IN THE CORRECTION OF SYMPTOMS DUE TO REFRACTIVE ERRORS

	Oculist	Optometrist
Total no. of students examined	709	655
No. with symptoms, wearing glasses	37	107
Percentage with symptoms, wearing glasses	5.2	16.3
No. with change in visual acuity since last examination by	23	29
No. with symptoms, wearing glasses, with visual changes deducted	14	78
Percentage with symptoms, wearing glasses, with visual changes since last examination deducted	1.9	11.1

State laws governing the practice of optometry

The laws governing the practice of optometry vary in different states. Some are very definite and limited, while others are more elastic. Let us quote some of these.

California[1]—The practice of optometry is the employment of any means other than the use of drugs for the measurement of the powers or range of human vision or the determination of the accommodation and refractive state of the human eye, or the scope of its functions in general, or the adaptation of lenses or frames for the aid thereof. Texas,[2] North Carolina,[3] and Pennsylvania[4] have laws which are also very specific and similar to the above.

In Indiana[5] the practice of optometry is defined to be any of the following acts, or any combination of, or part of the following acts:

(a) Examination or diagnosis of the human eye, to ascertain the presence of abnormal conditions or functions which may be diagnosed, corrected, remedied, or relieved; or the application or prescription of lenses, prisms, exercises, or any physical, mechanical, physiological, or psychological therapy or the employment of any means, for the purpose of detecting any diseased or pathological condition of the eye, which may have any significance in a complete optometric diagnosis of the eye or its associated structures.

(b) The application, use, or adoption of physical anatomical, physiological, or any other principle through scientific professional methods and devices to the examination of the eyes and vision, measuring their function for determining the nature and degree of their departure from the normal, if any, and the adopting of optical, physiological, or psychological measures, and for the furnishing or providing any prosthetic or therapeutic devices for the emendation thereof.

Most of the original laws governing the practice of optometry date from 1919, although there were a few states which had some regulations as early as 1909 and 1911. State statutes have been revised from time to time until at present the rules and regulations governing the requirements for licensing and conduct of the optometrists are much improved. Oklahoma,[6] California,[1a] Ohio,[7] New York,[8] Vermont,[9] Indiana,[5a] New Jersey,[10] Minnesota,[11] Virginia,[12] Idaho,[13] Maine,[14] Missouri,[15] and Florida[16] now have, or will have in effect next year, laws requiring that optometrists must be graduates of a recognized high school and subsequently graduated from a four-year course in an optometry school recognized by the International Optometry Board.

Pennsylvania,[4a] New Hampshire,[17] Rhode Island,[18] North Carolina,[3a] Tennessee,[19] Iowa,[20] Massachusetts,[21] and Louisiana[22] require graduation from at least a three-year recognized school of optometry. In 1939 or 1940, the New Hampshire Board is recommending that two years of regular college and two years of intensive optometrical work in a grade-A optometry school and a one-year apprenticeship in an optical establishment be required.

Florida,[23] Wisconsin,[24] Illinois,[25] Colorado,[26] Kansas,[27] Montana,[28] West Virginia,[29] and Oregon[30] require only two years of optometry training after graduation from a four-year high school. Illinois statutes are particularly weak, in that they not only fall in this group, but also allow candidates to be admitted to the State Board examination by serving an apprenticeship of two years to a registered optometrist.

Several of our states have passed regulations within the last one to three years, prohibiting "bait" advertising, price advertising, free examination, free consultation, or any similar catch phrase, statements of exaggeration, high-sounding technical terms, unsupported claims

of superior service or ability, employment of steerers to obtain business, and advertisement of the down-payment plan. Among these states are North Carolina,[3b] Wisconsin,[24a] Massachusetts,[21a] West Virginia,[29a] Virginia,[12a] Minnesota,[11a] Indiana,[5b] Washington,[31] California,[1b] Oklahoma,[6a] Florida,[23a] New Jersey,[10a] and Tennessee.[19a]

The use of "Doctor" as a prefix, without using optometrist as a suffix, or in any way suggesting that the examiner is a physician or other practitioner, constitutes a cause for revocation or suspension of his certificate of registration in the states of Minnesota,[11a] Pennsylvania,[4b] Florida,[23b] California,[1c] and Colorado.[26a] In New York,[8a] the degree Doctor of Optometry is not conferred unless that person has graduated from a school of optometry conducted as a department of a university, registered by the Board of Regents with either B.A. or B.S., and a certificate of graduation in optometry.

Some state optometry laws require specified equipment that the optometrist must have. It is also a requirement of Florida,[23c] Massachusetts,[21b] and Ohio[7a] that complete case records must be kept, including the following:

Vision
Ophthalmoscopic finding
Corneal curvature
Retinoscopic findings
Muscle coördination in reading
Presbyopia determination
Prescription, if prescribed
Vision corrected:
Fusion (stereoscopic appreciation)

Requirements of "Class A" optometry schools

In 1933 and 1934 a survey of all the optometry schools was made resulting in the adoption by the International association of Optometry Boards in the Toronto 1934 convention of the list of accepted and classified optometry schools. There are 10 Class-A schools at present:

1. College of Optometry, Toronto
2. Columbia University School of Optometry, New York
3. Los Angeles School of Optometry, Los Angeles
4. Massachusetts School of Optometry, Boston
5. Northern Illinois College of Optometry, Chicago
6. Ohio State University College of Optometry, Columbus
7. Pennsylvania State College of Optometry, Philadelphia
8. Southern College of Optometry, Memphis
9. University of California School of Optometry, Berkeley
10. University of Montreal School of Optometry, Montreal

Columbia University and Los Angeles School of Optometry have required a four-year course since 1928 and 1934, respectively. Two hundred and four students have been graduated from the Columbia four-year course. There were 61 seniors this year. The Los Angeles School of Optometry has graduated 119 since the four-year course was inaugurated, with 40 of this group finishing in 1939. The Pennsylvania State College of Optometry began its four-year course in 1936 and has entered approximately 115 students per year. The class of 23 seniors graduated last term were the first group to have completed the four-year course. The Northern Illinois College of Optometry has 97 students enrolled in the four-year course, which was inaugurated in July, 1938. According to the statistical addenda 1937-1938 of the University of California, there are 12 students taking the two-year pre-optometry course and 17 students were registered as graduate students in the professional department of optometry. No accurate statistics were received from the remaining Class-A schools.

All of these schools have required a four-year course in optometry beginning September, 1938. The general outline of

the curriculum of this four-year course of study is presented:[5c]

First year	*Hours*
Physics	120
Chemistry (general)	340
Biology (including comparative anatomy)	280
Bacteriology	128
Mathematics	240
History of optometry	32
Second year	
Anatomy (histology and embryology)	317
Physiology (including physiological optics)	272
Ophthalmic mechanics	
a. Physical principles of lenses	168
b. Principles of lens making	96
Optometry	96
Geometrical optics	180
Chemistry (physiological)	119
Third year	
Pathology (general)	176
Pharmacology	164
Ocular pathology	102
Geometrical optics	108
Ophthalmic mechanics (clinical application of lenses)	96
Optometry (including physiological optics)	144
Clinical optometry	332
Psychology (experimental and visual)	96
Surgery (lectures and demonstration)	36
Office practice	20
Fourth year	
Ocular pathology	152
Clinical ocular pathology (treatment of disease)	60
Geometrical optics	68
Ophthalmic mechanics (advanced methods in clinical application)	120
Optometry	144
Clinical optometry and conferences	552
Visual fields	36
Orthoptics	48
Subnormal vision	24
Surgery, ocular (clinical and hospital demonstrations)	60

The University of California[32] optometry course is under the Department of Physics of the Letter and Science College. The student must have a junior standing in the Letter and Science College together with the prerequisite courses. Columbia University[33] also requires junior standing for admittance to its optometry school, and at the satisfactory completion of the junior and senior year confers the B.S. degree.

A rather detailed description of the third and fourth year in optometry at Columbia University will serve to enlighten us on the type of instruction given in the better schools of optometry.

Junior year. Geometrical optics, anatomy and physiology of the eye, theory of optometry, drafting, physical optics (facts connected with subjects as interference, diffraction, polarization, double refraction, photometry, illumination, spectroscopy. Optic shopwork—history and manufacture of glass and lenses and their composition, neutralization, surface grinding, centering, and so forth. Practice of optometry (ophthalmoscopy, static and dynamic skiametry, simple subjective eye testing).

Senior year. Advanced geometrical optics (subjects treated: weak lenses, combination of lenses and mirrors, optical system of the eye, optical instruments used in conjunction with the eye, aperture of field view, optometrics, correction glasses, magnifying power, chromatic aberration, and so on). Physiological optics—anatomy and dioptics of the eye, including schematic eye, ophthalmometry, ophthalmoscopy, skiascopy, accommodation, visual acuity, anomalies of refraction and others. Optical shopwork—deals with frames, edging and polishing, surfacing, fitting, and adjustments. Theory of optometry—symptomatology, examination of extrinsic and intrinsic ocular condition (strabismus, anisometropia, and so forth), fitting of spectacles, special instruments such as slitlamp, and refraction studies. Practice of optometry—pathological condition of the eye (differentiation between healthy and abnormal eye). Diagnosing of pathological conditions under direction of instructor. Optometrical laboratory, geometrical optics—theory of optical instruments, aberration, astigmatism, astigmatic lenses and spectacle optics. Optical work shop, conservation of vision.

The Southern College of Optometry was to begin a four-year course in the fall of 1938. Its catalog[34] states that by the time the student optometrist graduates, he should be able to recognize the usual ocular diseases and should be capable of differentiating between normal and morbid condition, often a very difficult feat. Ocular operations of various types are demonstrated to small groups. The present second-year clinical optome-

try studies include history taking, complete ophthalmoscopic, refractive, muscle, and perimetric examination, prescription writing, mounting lenses, fitting frames, collecting bills, dismissing patient, and writing and mailing the patient a follow-up letter. The catalog further states that the students are capable refractionists by the end of the second year.

Some of the optometry schools also include hygiene of the eyes, optometrical psychology, a greater amount of surgery lectures and demonstrations, and more emphasis on pathology and diagnosis as related to other diseased conditions of the body, optometrical ethics and publicity, optometrical jurisprudence, and optometrical economies.

It is apparent that sooner or later all states will require an optometrist to be a graduate from a recognized Class-A school of optometry before he will be admitted to the state examination for license to practice.

The objectives of modern optometry

The objectives and limitations of the optometrist as related by B. W. Hazell,[35] chairman of the educational committee, International Association of Optometry Boards, follows:

1. He must be educated in our professional school and be able to correct and treat all refractive errors.
2. He must obtain sufficient knowledge and be able to diagnose all diseases that in any way affect vision.
3. He must be given a thorough knowledge of the brain and all the nerves connected therewith.
4. He must be able to diagnose any pathological condition that affects vision.

His education must be sufficient to make him a recognized eyesight diagnostician. This knowledge obtained by the future optometrist is not for the purpose of practicing medicine, but is needed for diagnosis so as to enable him to intelligently guide his patients to the physician most capable in treating the condition present.

It is interesting to note some of the broad objectives sponsored by certain of the optometry colleges. The catalog from the Pennsylvania State College of Optometry[36] defines optometry as the science which deals with the structure, function, and diseases of the eye. The practice of optometry is defined as the ascertaining and correcting of abnormalities of the human eye and accessory visual system. "The practice of optometry utilizes its fundamental sciences directly to a greater extent than any other profession dealing with the human body."[36] The first two years of training include the fundamental sciences such as mathematics, physics, geometrical and physical optics, chemistry, anatomy, physiology, pathology, and pharmacology. The last two years include theoretical and applied optometry, physiological optics, ocular therapeutics, advanced ocular diagnosis, principles of surgery, and clinics.

Some of the objectives to be derived from the course in physiology are:

2. To use physiology as a basis for the study of pharmacology, pathology, clinical optometry.
4. To understand the physiologic basis of diagnostic procedures which the practicing optometrist may find necessary to utilize or which he may request a consulting physician or laboratory diagnostician to apply.

Aside from investigating physiological principles, the students are enabled to familiarize themselves with the use of operative instruments and the action of drugs.[36b]

Objectives of the bacteriology course—

1. To understand and appreciate the part played by microörganisms in the production of disease, including ocular and other diseases and sequelae.
2. To use bacteriology as a partial foundation for the study of later courses of the ocular curriculum which deal with prevention, diagnosis, and treatment of ocular diseases.
3. To use bacteriological methods in the pre-

vention, diagnosis, and treatment of ocular disease.[36c]

Objectives of the pathology course—

General Pathology:

1. To recognize and understand disease process, morbid anatomy, and physiology.
2. The application of anatomy, chemistry, physiology, and bacteriology to the explanation of disease processes.
3. To relate chemical manifestations of disease to anatomic and physiologic changes associated with disease.
4. Pursue the study of later courses which deal with the prevention and treatment of ocular disease.

Ocular Pathology:

1. To understand and recognize disease processes, morbid anatomy, and physiology of ocular region.
2. To estimate the outcome of the disease processes under study with and without treatment.

The student is drilled in the symptomatology and differentiation of diseases of the eye and appendages. Manifestation of ocular conditions as associated with systemic diseases, and the significance of alterations in blood pressure and urine are stressed.[36d]

Chemistry Objectives:

The understanding of the principles underlying the chemical processes taking place in the body with special reference to their application to clinical optometry and to chemical examinations which the optometrist may require for his practice.[36e]

Pharmacology Objectives:

1. To understand drugs, systematically prescribed for patients who come to the optometrist's office.
2. To familiarize the student with pharmaceutical preparation used in ocular diagnosis and therapeutics.
3. To familiarize the student with the action of drugs on the vital tissues.
4. To enable the student to read and evaluate literature and discussions on subjects of pharmacology.

Students are required to become familiar with prescription writing and therapeutic dosage of all ocular medicinal preparations.[36f]

Ocular Therapeutics—Objectives:

1. To understand the clinical application of the principles learned in pharmacology.
2. To understand the general procedure followed in ocular therapeutics.
3. To recognize ocular manifestations of systemic disease, the physiological action of drugs, and the study of applied therapeutics with consideration of the conditions under which each drug may be used in the examination and treatment of ocular disease.[36g]

H. E. Pine,[35a] president of the American Optometric Association, states, "Optometry, in my opinion, has a very bright future and is destined to eventually be a profession to which is allocated the detection and correction of all ocular difficulties. The modern optometrist now is so far ahead in refraction of others who have invaded this field, that it will be impossible for medical propaganda to keep this fact from general public acceptance."

Many of the more progressive and conscientious optometrists realize and have admitted that it is necessary for a person dealing in the examination and correction of abnormal vision to know the anatomy, physiology, etiology, pathology, and clinical diagnosis of diseased conditions of the body that may affect the eye as well as the detailed or minute knowledge of the abnormal ocular condition and the correction thereof. Unless physicians and surgeons have been sadly misinformed through the teachings of our medical schools, the most important objectives of medical training are prevention, diagnosis, and treatment. Diagnosis is very important, and it cannot be thoroughly learned in one or two years. Didactic work in itself is not sufficient. An abundance of clinical material portraying all the variations from the normal are necessary in order that the student may actually see these abnormal cases. After the proper diagnosis is made, treatment can be instituted. Most of our pres-

ent-day optometry schools are attempting to teach the diagnosis of all ocular abnormalities and how these disorders may be related to all other diseased conditions of the body. Some of the optometry schools even give instruction in drugs and surgery.

Although anatomy, pathology, and therapeutics are taught by physicians in a few of the optometry schools, by far the majority of the instruction is done by persons with a Bachelor's or Master's degree or by "Doctors of Optometry."

Fortunately, the majority of people do not have serious diseases of the eyes. But we cannot ignore the not-infrequent loss of vision from chronic simple glaucoma and uveitis from lack of adequate care, and the fact that failing vision may be one of the earlier symptoms of some more serious disease for which it is most important that proper early diagnosis and treatment be sought, for the correction of the disease and the conservation of the patient's vision. A pair of glasses only serves as a visual crutch for that individual. It does not remove the cause. Just because the majority of persons do not have serious eye diseases makes it a bad policy to ignore looking for these diseases when making an ocular examination.

The optometrists' criticism of the ophthalmologist as a refractionist

The optometry profession condemns the medical profession in the refraction of eyes. There are two facts for which, at least superficially, they are somewhat justified in their criticism. The optometrists publicize the fact that the science of theoretical and applied optometry is not taught in our medical schools. It is true that the tradesman's aspect of lens grinding, fitting of frames, and detailed study of theoretical and applied optometry are not a part of the regular medical curriculum. The pre-medical training includes courses in physics, trigonometry, chemistry, and the biological sciences, followed by the physiology of the eye, visual fields, didactic work, and eye clinics in the regular medical courses. The regular medical curriculum does not adequately train the physician for any specialty. In order to be a capable specialist in any branch of medicine, whether it be dermatology, neurology, psychiatry, urology, radiology, ophthalmology or otolaryngology, any of the special divisions of surgery, or any of the other specialties, the physician must take postgraduate work. No physician is considered a specialist when he is graduated from a medical school. However, the background of general medicine is the only firm foundation on which a specialty can be built. The second objection the optometry profession raises is that there are no restrictions to prevent the licensed general physician from testing the refraction of eyes. This is true, but in this day of increased medical knowledge few physicians feel capable of confining themselves to a specialty unless they have spent adequate time in postgraduate work preparing for that specialty. In table 3 it will be noted that of all the students examined by physicians, only 5.1 percent had refractions performed by the general physician, as checked against the American Medical Association Directory. Eye, ear, nose, and throat specialists examined 37.1 percent of the students (the amount of specialization not designated) and 57.8 percent of the students were examined by physicians belonging to one or more of the following groups: American Academy for Ophthalmology and Otolaryngology, American Board of Ophthalmology, American Ophthalmological So-

ciety, American College of Surgeons.

Another objection to the ophthalmologist frequently used by the optometrist is the use of "drops" or cycloplegics in the eye, but there are many cases where cycloplegia is necessary, especially in children and young adults, for a thorough examination. In the cross-eyed child complete atropine cycloplegia is an absolute necessity for proper refraction. The optometrists are prohibited by law from using drugs in the eye or internally. Would this be a very vital reason for their objection to the use of "drops"? Undoubtedly one reason for the difference in the results obtained by the two professions (table 1) is that a cycloplegic was needed in many of these cases for proper examination and refraction.

Certainly, diagnosis is very important. One of the purported objectives of optometry is to be able to diagnose all disorders of the eye. Several of these schools teach the action of drugs, therapeutics, and ocular surgery, even though they are prohibited by law from using them. Where is the line of demarcation to be drawn between the two professions? There are no short cuts in the preparation to practice general medicine or any of its specialties, and the diseases and disorders of the eye are no exception. Four years is now required for graduation from most optometry schools. The ophthalmologist spends about six years more than this in his preparation.

Needs for better regulations governing the medical specialties

There is a recognized need for more adequate control of our medical specialties. The ideal arrangement would be to require a general medical education and then a specified amount of postgraduate work in ophthalmology for all persons who are planning to take up this profession as a specialty. State specialty boards or state medical boards should be given the power to determine the proficiency, whether it be by credentials, examination, or certification by the American Board of Ophthalmology, and to register or license those properly trained to practice this particular specialty. In fact, this should apply to other specialties in medicine as well. Not only would this raise the standards of the medical profession beyond criticism, it would insure to the public the adequate ability of any physician practicing that specialty.

TABLE 3

Comparative study of physicians doing refraction

	General Physician	*Oph. and Boards	**OALR	Total exam. by physician
Number of students examined by	36	410	263	709
Percentage examined by	5.1	57.8	37.1	52
No. with incorrect vision with glasses, examined by	7	60	65	132
Percent with incorrect vision with glasses, examined by	19.4	14.6	24.7	18.6

* Physicians practicing only ophthalmology and physicians belonging to one or more of the following—American Board of Ophthalmology, American Academy of Ophthalmology and Otolaryngology, American Ophthalmological Society, American College of Surgeons.

** No data as to the amount of specialization done in ophthalmology.

Need for better control of the practice of optometry

Due credit must be given the present-day optometry profession for raising its standards within the past 20 years to

TABLE 4

STUDENT ANSWERS TO QUESTION, "WHAT IS THE DIFFERENCE BETWEEN AN OCULIST AND AN OPTOMETRIST?"

Total No.	No. Wrong	Percent Wrong	No. Correct	Percent Correct
1873	1389	74.1	484	25.8+

the level described herein. Unfortunately, many optometrists are still in practice who know very little about refracting and nothing about the diagnosis of pathological conditions of the eye. If optometry is to serve the public efficiently, better training under competent men in the field of the medical sciences must be given if the causative factors of defective vision and pathological conditions are to be recognized readily. With the increasing knowledge of physiology, etiology, and pathology of ocular abnormalities and their treatment, the practice of optometry is gradually converging toward ophthalmology.

Today very few people actually have any conception of the difference between the oculist and the optometrist. In a survey made (table 4) 1,873 university students were asked to differentiate the two terms. Even with very liberal grading only 25.8 percent had some idea of the difference and 74.1 percent were entirely uninformed or misinformed on these terms.

Some criticism has been raised in reference to the prices paid for eye examination and glasses. In order to ascertain the comparative prices between the optometrist and the oculist, statistics were gathered on the prices paid by the students, according to the degree of eye defect. In table 5, the results are tabulated. The average charge made for the oculists' examinations and for glasses was $16.50, whereas the cost for examination and glasses obtained from the optometrist averaged $15.00. It will be noted the variation in price is greater in the optometrist group in five out of the eight defect classes.

TABLE 5

COMPARATIVE PRICES PAID FOR OCULAR EXAMINATION AND GLASSES BY STUDENTS

Vis. defect without glasses	Oculist			Optometrist		
	Number students	Av. Price for exam and glasses	Var. in price	Number students	Av. price for exam and glasses	Var. in price
20/20	133	$16.45	$6.50–25.00	137	$15.08	$5.00–27.00
20/25	89	15.75	7.50–30.00	121	14.17	7.00–34.00
20/30	48	15.77	8.00–27.00	63	15.32	7.50–38.00
20/40	32	16.00	10.00–16.50	38	14.28	8.00–20.00
20/50	30	16.40	10.00–25.00	19	13.42	10.00–17.00
20/65	32	17.57	9.00–30.00	54	15.46	7.00–23.00
20/100	71	17.50	6.00–41.00	59	14.72	8.00–25.00
20/200	139	17.00	7.50–35.00	157	16.00	7.00–45.00
Total	575	$16.50		648	$15.00	

Average price of both oculist and optometrist = $15.75

SUMMARY

A study of 1,416 students has revealed that 37.8 percent examined by the optometrist and 19 percent by oculist did not have normal vision with glasses as de-

termined by the Snellen test. After deducting those cases with marked change in visual acuity within the last year there still remained 32.3 percent examined by the optometrist and 6.7 percent by the oculist who had defective vision with glasses.

After deducting those students with visual changes since their last examination by the oculist and optometrist there remained 1.9 percent and 11.1 percent respectively, of the students with symptoms related to ocular disorders.

Practically three fourths of the students were unable to differentiate the oculist from the optometrist.

The average cost of the ocular examination and glasses was about 10 percent greater in the oculist group than in the optometrist group.

There is need for better medical regulations to determine the proficiency, and for the registration and licensing of physicians representing themselves as specialists.

The Class-A schools of optometry have raised their requirements to a four-year course. Several of these schools are attempting to teach pathology and diagnosis. Examples of the curricula are given. In the light of existing circumstances it would seem that much of the teaching is "futile." Since a knowledge of general medicine is a necessary foundation for the study of the etiology, pathology, and diagnosis of ocular disease, and there exists such a limited number of capably staffed postgraduate institutions, optometrists according to their present preparation can never serve the public as efficiently as can the ophthalmologists. Eventually, if the practice of optometry is to continue in the direction it is now pursuing, the medical schools may find it necessary to absorb the teaching and control the practice of this profession.

Otherwise, when and if the professional standards and ethics for the practice of optometry reach a higher plane, it may be possible that the same coöperation may exist between the medical and optometry professions as is now present between the practices of medicine and dentistry in serving the public efficiently.

Eye, Ear, Nose and Throat Hospital.

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DYSTROPHIA ADIPOSA CORNEAE

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At the meeting of the American Ophthalmological Society held in 1932, Dr. Dewey Katz reviewed the literature on this subject and presented the ninth reported proved case. It is my purpose to offer a case of this nature and to bring to date the reference in the literature. My case has not been proved by microscopic examination of corneal tissue.

CASE REPORT

I. M., a colored female, aged 28 years in 1932, at the time of her first visit, was sent to me by the Illinois Emergency Relief Commission because of her complaint of sore eyes. She stated that she had had "white scars" on both eyes as long as she could remember and that the "scars" were slowly increasing in size (fig. 1). She had had several attacks of very sore eyes with watering, redness, and sensitiveness to light. Since the age of 14 years she had developed increasing numbers of small and large fatty tumors of the skin, irregularly distributed over the body, extremities, head, and neck.

On the date of the first examination the vision was 3/60 and 6/60, not improved. Lids, cilia, and lacrimal apparatus were normal. The palpebral and bulbar conjunctiva in both eyes showed

Fig. 1 (Knapp). Dystrophia adiposa corneae

moderate injection, and there was a mild pericorneal injection present in the right eye. Ocular movements were normally performed. The cornea of the right eye showed one rather large patch of solid white area about four millimeters in diameter. There were no plaquelike deposits around the limbus. The cornea of the left eye showed a similar but larger patch of solid white, calcareouslike deposit oc-

cupying about one third of the lower half of the cornea below the normal pupillary area. Superficial and deep vessels passed into the cornea in the vicinity of this opaque area. The corneal reflex was normal in both eyes. Anterior chambers, irises, and fundi were normal. The tension was 18 mm. in the right eye and 20 mm. in the left eye (Schiötz tonometer with normal readings of 18 to 22 mm.).

Slitlamp examinations showed deep and superficial corneal vessels. The corneal opacities lay within the corneal stroma. There was no bulging of the corneal surface. The margins of each deposit were clearly outlined. The deposits appeared to be of completely homogeneous structure.

Physical examination revealed nothing of especial importance except for the cutaneous xanthomatosis, as diagnosed by an internist (figs. 2 and 3). He described multitudes of fatty tumors, some circumscribed, some lobulated, some flattened, some pedunculated, covering most of the skin surface except the soles of the feet and palms of the hands. These tumors seemed to originate in subcutaneous tissue, and some were tender. One tumor excised from the chest showed, microscopically, fat in large dilated cells, arranged in compact lobules held together by a fibrous stroma. This type of lipoma is said to be a slow-growing tumor increasing within itself, expanding so as to compress surrounding tissues or to project above the body surface. Although commonly described as tumors, this type seems to be rather the result of local accumulations of lipoid substances in degenerated cells. It is most usually found in association with jaundice, diabetes, pregnancy, and other conditions in which the lipoid content of the blood is altered. These tumors also are present in internal organs, the mesentery, in the submucous and subserous tissues of the whole alimentary tract, and even in the meninges.

On our patient blood examinations gave normal results. Urinalysis and Wassermann and Kahn tests on blood and spinal fluid were twice negative. Four blood cholesterol determinations in varying relations to meals were within normal limits (162 to 199 mg. per 100 c.c.). Ear, nose, and throat examinations were negative. X-ray studies of sinuses, head, long bones, and chest were not interesting. Dental examination showed many losses, some pyorrheal infection but no apical abscesses. Pelvic examination suggested the presence of sequellae of an old gonorrheal process.

Over a period of six years there has been a slow but steady increase in the size of the corneal lesions. It seems likely that the entire cornea of each eye will eventually be affected. The original lesions now show definite staphyloma formation. There have been numerous periods of smarting, burning, injection, lacrimation, and photophobia, lasting from a few days to three weeks. Between these attacks the inflammatory symptoms have been absent. Vision was decreased to 1/60 and 3/60 with the best correction, a minus sphere. In spite of the disability, the patient has been able to continue arduous W.P.A. duties.

The question of a corneal transplant has been considered but any type of operation is flatly refused.

Discussion

It is the opinion of Katz and Delaney and E. V. L. Brown that fatty degeneration of the cornea occurs as a result of some unexplainable impairment of the physiological functioning of the corneal cells. Pyknosis and vacuolation occur in these cells. Fat brought to the cornea is not completely oxidized and is deposited

Figs. 2 and 3 (Knapp). Distribution of fatty tumors over skin surface, except soles of feet and palms of hands.

within the cells in the form of cholesterol and its esters. These fat deposits within the cornea result in a chemical irritation producing vascularization of the cornea and pericorneal injection.

While it seems likely that the incidence of fatty degeneration of the cornea is larger than is indicated by available case reports, there are several differential diagnoses to be made. For example, there is the xanthomatosis bulbi of von Szily, occurring after injuries and affecting various portions of the eyeball; there is the fatty degeneration of the cornea secondary to inflammations of the cornea or uveal tract; and there is Axenfeld's dystrophia calcarea.

The first reported case found was that of Kamocki in 1893 (Archives of Ophthalmology, 1893, v. 39, p. 209), who at this time described the cells now known as histiocytes that are characteristic of the microscopic picture. The last reported case found was that of Takajasu (Archives of Ophthalmology, 1936, v. 96, p. 872). All showed lacrimation, pericorneal and conjunctival injection, the characteristic corneal deposits, and a decrease in visual acuity. Some showed reduced corneal sensitivity; some lacked the histiocytes described by Kamocki. In none was there evidence of previous inflammation of cornea, sclera, or uveal tract. Ages varied from 16 to 65 years. In some the blood-cholesterol content was normal, in some as high as 266 mg. per 100 c.c., and in some undetermined. In some the corneal deposits were central and in some peripheral. In 15 cases the disease process was bilateral, and in three cases unilateral.

The typical microscopic picture, best described by Delaney, showed a variation in thickness of the epithelial layer of the cornea caused by a variation in the number of cell layers (from three to five) and by a change in the shape of the cells in the basal layer from columnar to

cuboidal. Occasional mitotic figures are present in the basal-cell layer and rarely in the middle-cell layers. There is a marked increase in the numbers of wandering cells, leucocytes, and lymphocytes, great numbers being present on Bowman's membrane between the basal cells. Between the basal-cell layer and Bowman's membrane there is usually found an increase in connective tissue with many spindle-shaped nuclei. Bowman's membrane is frequently split into lamellae, and there are areas in which this membrane is completely absent. The lamellae of the corneal stroma vary greatly in thickness. Many show degenerative phenomena, such as vacuolation. Large numbers of neutrophilic leucocytes, an increased number of lymphocytes, and some pyknotic nuclei are present. In formaldehyde-Zenker-fixed Giemsa-stained sections, large, oval-shaped, pale-staining nuclei resembling endothelial cells are found in the widened interlamellar spaces. Among these cells a majority of reporters found many histiocytes varying in size, with well-stained nuclei and nucleoli, vacuolated cytoplasm, and fairly well-outlined margins. The accumulations of leucocytes and lymphocytes are more dense in some areas and show no definite relationship to blood vessels. Sections stained with hematoxylin and scarlet red show granules, or masses, or both, in all layers of the cornea except Descemet's membrane and the endothelium. In the corneal stroma the diffuse fatty distribution varies considerably and intensely. In places fat droplets coalesce to form irregularly shaped fat bodies in varying sizes. The greater part of the fat so stained was extracellular, although red-stained fat-laden histiocytes were readily identified. In Delaney's opinion there was proof that although neutral fat was present, the fat substance in the pathologic corneae consisted mainly of the cholesterol-fatty-acid group.

The connection between the lipomatosis and the corneal dystrophy in my case has not been established. The authors of the various previously quoted reports of fatty degeneration of the cornea differ in their opinions as to whether the fat changes present were in the nature of an infiltration or degeneration. Many pathologists have ceased to speak of "fatty infiltration" and "fatty degeneration" because of the frequent impossibility of differentiating the one from the other. They use the term "fatty change" for all fatty processes.

Virchow's definition of fatty infiltration—an excessive accumulation of fat in the cells in the form of large droplets without destruction of the nucleus or irreparable damage to the cell—was postulated in 1847 and is still uniformly accepted. In this condition the fat enters the cell from without; in the form of fat droplets, it fuses together under the pressure of the cytoplasm; the cell remains structurally normal or nearly so; it is not functionally damaged and is capable of returning to its normal condition whenever the fat is removed. Under normal conditions there is little free visible fat in the cells of the parenchymatous organs, because it is largely used up through oxidation by the action of the intracellular oxidase. When, for any reason, the oxidative power of the parenchymatous organ is reduced, fat accumulates in it, and we find an excess of fat in the parenchymatous cells. When oxidation in a cell is checked by toxins, poisons, loss of nutrition, or other means, the accumulation of fat brought to it will go on uncontrolled. Added to this is the fact that each cell contains lipins—fats and lipoids—the amount of which varies with the different organs. The lipins are so combined that they are not

stained with the usual fat stains nor can they be extracted with ether. They are referred to as "invisible fat." They, however, become liberated during an autolytic process and become "visible"; that is, identified as lipins by certain of the fat stains or by polarized light. Thus, when we have the accumulation of fat in a disintegrating cell, we have fatty degeneration. The fat in this process may enter the cell from without or may be derived from within, usually both; the cell is functionally damaged and would be incapable of returning to its normal condition were the fat removed.

In distintegration of tissue, cholesterol and its esters accumulate because these substances are not very soluble and are not destroyed during autolysis. The characteristic plates of cholesterol may be seen in any tissue in which cells are undergoing slow destruction. Cholesterol and its esters may be slowly removed by the histiocytes that phagocytose these substances. These cells are often found surrounding them.

It is believed that when the blood contains an excessive amount of fat, it passes in larger amount than normal into the blood lymph and thence over into the tissue. The role played by the cholesterol is not certain. It is probable that it serves as a vehicle in the transportation of fat. It is possible that it may also favor the precipitation of neutral fat out of the tissue fluids into places where deposition of neutral fat alone does not usually occur.

That another factor besides a high cholesterol content of the blood is essential in the production of a lipomatosis or a dystrophia adiposa corneae is shown by the fact that in various other diseases—lipoid nephrosis, for example—the cornea remains uninvolved although the blood cholesterol is far above the high normal.

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THE EFFECT OF SULFANILAMIDE ON THE COURSE OF TRACHOMA*

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The introduction of sulfanilamide as a therapeutic agent primarily for streptococcal infections was received with unprecedented acceptance by the medical profession at large. Faith in its chemotherapeutic capacity became so extensive as to tender it experimental trial in a large number of infections, bacterial, viral, protozoal, and rickettsial. It was perhaps only a natural sequence that with time the effectiveness of sulfanilamide in trachoma also be determined. Since the original report by Heinemann,[1] followed rapidly by that of Lian[2] and Dik,[3] several publications have appeared in this connection, as will be brought out in the discussion of this paper. The success of this treatment, however, was so striking in Loe's[4] experiments, that when the opportunity was afforded to conduct a therapeutic study on the Navaho reservation, as published elsewhere,[5] it was proposed to investigate simultaneously the possibilities of sulfanilamide in trachoma. With the facilities and coöperation of the U. S. Indian Service,** this study has been completed and the present communication is a report of the results observed.

METHODS OF STUDY

Except for six white patients who were treated later at the Washington University Medical Clinics, the survey was carried out on Indians. The treatment recommended by Loe[4] was adopted bodily for the large majority of the patients, what modifications were made being dictated to a great extent by uncontrollable conditions. Loe's method consists of oral administration of sulfanilamide, one-third grain per pound of body weight for the first 10 days of treatment, with a reduction to one-fourth grain for the following 14 days. The daily total was divided into three doses in multiples of five grains and any inequality of sulfanilamide on this basis was compensated by giving the largest quantity in the evening before retiring. An equivalent amount of sodium bicarbonate was given in tablet form. In addition, it was found desirable to irrigate the eyes each morning with saline-boric-acid solution, and in a few instances atropine was applied locally when indicated to mitigate the pain and discomfort of corneal ulcers.

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The progress of the treatment was followed by clinical examination and by determination of visual acuity at the end of each week. In order to control the toxicity of the drug, temperatures were taken each day and in the majority of the patients complete blood counts and hemoglobin estimations were made at least twice a week, the latter values being determined by the Sahli method. Other toxic symptoms were established by clinical observation.

Results of the treatment

In order to facilitate a more coherent presentation and discussion of the data, it seems necessary to consider the results of treatment in reference to the variety of trachoma studied. For this purpose, the different patients have been classified as representative of (1) primary, uncomplicated trachoma, (2) trachoma superimposed with secondary infection, and (3) so-called "flare-up" trachoma.

Effect on Uncomplicated Trachoma. Preliminary studies were undertaken in two groups of patients, one treated at Fort Wingate and the other at Shiprock, New Mexico. The first series was 24 in number, with uncomplicated trachoma in various stages. At the end of treatment, the condition in 3 was unchanged, in 17 improved, and in 4 arrested. It is interesting that six months later two of the older patients with corneal trachoma presented themselves for treatment at the Indian Service Hospital at Fort Defiance. Their corneal condition was active, although the lids, as previously, were of little importance. They were treated with tartar emetic, the condition becoming definitely improved though not arrested, and their vision was correspondingly better (cf. ref. 5, patients T_{10} and T_{11}). It may be pertinent to add that one of these patients underwent an acute "flare-up" two to three months following conclusion of treatment. A second course of sulfanilamide was carried through and the individual was followed for approximately a year in all. At the end of this time, his clinical condition was about the same as when originally observed. Two other patients in this group were examined six months later, both were improved but still clinically active. The second series of 24 patients included for the most part school children, but also several elderly individuals whose symptoms were predominantly of the cornea, with the lids well scarred and only slightly active. One month after conclusion of the treatment, the eyes of 2 patients remained unchanged, of 19 were improved, and of 3 were asymptomatic.

For purposes of orientation, seven children with folliculosis were treated in the manner indicated above, and the progress of the disease during treatment was followed comparatively. It was observed that at the end of the experiment the conjunctival condition remained unchanged. Apparently, then, sulfanilamide has no effect on folliculosis.

In a third and final group of patients, observations were continued in more detail and over a greater period of time. This group comprised 29 patients—28 Navahos and 1 white person. Except for two patients to be referred to presently, the disease was characterized by only minor corneal manifestations. Clouding was slight or absent, and pannus was in its early stages, or, expressed in other terms, visual acuity in these patients still remained normal. The conjunctival disease was active, appearing in some patients as follicular, in others as papillary, and in still others as a combination of both forms. With a single exception, the conjunctiva was free of scar tissue, the exception (S_1) exhibiting only streaks of scarring be-

tween the clinically active areas. The two patients referred to earlier in this paragraph were different in clinical appearance. One, an adult (S_{19}), had had repeated attacks over a period of years and had already received a course of treatment with sulfanilamide several months previously, and was now suffering from a recurrence. The lids were smooth and completely scarred, while the corneae were turbid and diffused with heavy, generalized pannus. His vision was O.D. 6/200, O.S. 8/200. The other (S_{31}) was a white patient, a wrestler, with recent infection. The lids showed a heavy folliculosis, the corneae were infiltrated, and pannus was moderate. Active corneal ulcers were present in each eye, and his vision, taken at the time, was subsequently discarded because of the acute condition.

In 26 of the 29 patients, sulfanilamide was given as prescribed above. In two (S_{10} and S_{13}) the treatment was varied because of toxic manifestations of the drug, while in the third (S_{31} above), therapy was started on a similar basis with sulfapyradine, 420 grains in two weeks, and since no improvement was apparent sulfanilamide was substituted, 840 grains over the 24-day period. Because of the active ulcers in both eyes treatment was supplemented first with atropine, then with three applications of silver nitrate, and later with metaphen.

At the end of treatment, the following results were observed: In one patient (S_5) the condition remained stationary in the right eye, and became more marked in the left; in 23 patients ($S_{1-4,\ 6-9,\ 10,\ 12-20,\ 22-26,\ 30}$) the disease maintained approximately the same clinical appearance; in 4 patients ($S_{9,\ 11,\ 21,\ 28}$) there was distinct improvement, although infection was not arrested, but still active; in the last case (S_{31}) the individual was completely asymptomatic. This particular patient (S_{31}) was examined once a month for four months, and during this interval there was no evidence of disease; apparently, therefore, a complete arrest.

Examinations were made for epithelial-cell inclusions before treatment was begun in order to determine their behavior under the influence of the drug. In six patients, inclusion bodies were found in sufficient numbers to make this experiment significant; in the others, they either were not found or were found in such scarcity (1 to 3 per slide) as to make any subsequent examination of doubtful significance. In all six of these patients, it was not possible to find inclusions by the end of the first week of treatment, and in some in even less time. The interpretation of this observation will be considered in the general discussion.

Since the remaining members of the group were far from asymptomatic, it was felt that the treatment with sulfanilamide should be followed by local, routine administration of copper. After one month, clinical examination with Dr. Polk Richards disclosed: 5 were discontinued as patients for various reasons, leaving a remainder of 23 (excluding S_{31}); of these, improvement was slight in 6, moderate in 4, and marked in 13 although they were still active. At Dr. Richards' suggestion, all local treatment was omitted, and two months later (three months after cessation of sulfanilamide) the condition in 18 remaining patients was: about the same in 3, moderately improved in 3, markedly ameliorated, though not yet inactive, in 11, and completely asymptomatic in 1. Approximately five months after sulfanilamide was terminated, a final examination was made jointly with Dr. Phillips Thygeson. At this time only 16 patients were available for observation and their condi-

tions may be summarized as unchanged in 8, and improved in 8, but arrested in none.

To recapitulate, with originally 77 patients suffering from uncomplicated trachoma, the prescribed course of treatment with sulfanilamide was carried out. At the end of the treatment only 8 cases were asymptomatic, 40 had improved definitely, and 29 were in approximately the same status. After an interval of five to six months after cessation of sulfanilamide it was possible to reëxamine only 22 of the patients under study. At that time 14 of this number were unchanged from their original status, and 8 manifested varying degrees of clinical improvement.

Effect on Trachoma Complicated with Secondary Infection. The patients classified in this group were 23 in number, all Navahos treated in the Indian Service Hospital at Fort Defiance, Arizona. They were all suffering from trachoma of varying intensity, but in each instance the condition was aggravated by the presence of secondary infection, more or less acute in character, with two of the patients, in fact, yielding gonococcus from the conjunctiva. The effect of sulfanilamide on the acute condition was rapid and conclusive; photophobia, exudate, and chemosis of the lids were eliminated usually within a week or 10 days. The general appearance of the eye became vastly improved and visual acuity increased, but the trachomatous process in each case was still active. Thus, of the 23 patients, trachoma was improved in 8, unchanged in 15, and arrested in none. In addition to the sulfanilamide, local treatment was given, with such medication as argyrol (25 percent), atropine (1 percent), silver nitrate (2 percent), copper sulphate (2.5 percent), chaulmoogra oil; and other medicaments, the choice of agent depending upon the clinical indications. It is only fair to add that 15 of the patients received sulfanilamide from 7 to 14 days only, while 4 took the drug in the prescribed quantity, and 4 others in excess, even as long as for 38 days. The duration of treatment was frequently reduced in this group, either because of toxic manifestations to the drug, desertion by the patient, or failure of the trachomatous process to respond satisfactorily. In any case, the conclusion seems justified that secondary infection was eradicated rapidly by sulfanilamide and that trachoma, while less active, was not arrested at the end of the treatment even when this was carried on considerably longer than prescribed.

It is interesting in this connection to include a patient under observation at the University Clinic. With one eye characterized by an old inactive process, and the other markedly inflamed with excessive purulent discharge, papillary lids, and extensive disease of the cornea including infiltration and generalized pannus, the case was considered aggravated by secondary infection. Accordingly the patient was placed on sulfanilamide in the recommended dosage for one week, which caused regression of the acute symptoms and a disappearance of both the bacteria and epithelial-cell inclusions originally present. His treatment was then continued with injections of tartar emetic,[4, 5] when the trachomatous condition was rendered inactive.

Effect on "Flare-up" Trachoma. Although in universal usage, the expression "flare-up" as applied to trachoma is rarely defined. While it sometimes connotes a definite clinical picture, there is a certain vagueness regarding its true meaning. To the writers, the term implies a sudden, explosive return of a condition clinically quiescent for months or years previously. As examples, two

patients immediately come to mind, both treated at the University Clinics as subjects in this group. One had been treated almost a year previously with tartar emetic and had been released as asymptomatic following the routine course.[5, 6] His subsequent admission was as an otolaryngological patient requiring a submucous resection. The day before the operation his eyes were examined and found to be completely without symptoms. The lids were smooth and pale, capillaries were quite evident, and there were delicate streaks of scar tissue; the corneae were of normal transparency and no vessels were grossly visible. Several days following the operation the patient complained of a retropharyngeal abscess and was given sulfanilamide for this condition. The patient was seen again by request two days later, when there was copious secretion, the lids were swollen, and the general appearance was acute and inflamed; there was a scattering of follicles on the lids and along the limbus; the corneae were clouded and invaded by a well-developed pannus. The second patient, apparently asymptomatic over a period of nine months, developed a severe cold, during which a fulminating trachoma, particularly of the cornea, rapidly returned. The two examples submitted indicate that while the virus may perhaps remain in abeyance in tissues clinically quiescent, a nonspecific stimulation, such as unrelated infection, may precipitate a condition clinically disproportionate to the rate of its appearance. The factors of nonspecific irritation and time, perhaps more than any other, distinguish "flare-up" trachoma from other forms of relapse or genuine reinfection.

This variety of trachoma, then, was represented by 18 patients, 13 Navahos treated at Fort Wingate, New Mexico, and 5 whites at the Washington University Clinic. These individuals were started on sulfanilamide in the usual manner, but none required the full course of treatment. Improvement was prompt, the condition in the lids becoming arrested in 10 to 20 days. The corneae were markedly improved, infiltration disappeared and while about half still showed large capillaries, the infection was considered inactive. Thus, in contrast to the patients described above with primary uncomplicated disease, the effect of the drug appears to be rapid and conclusive.

Toxic reactions to sulfanilamide

Current medical literature is replete with the various toxic manifestations induced by sulfanilamide. The toxicity is protean and unpredictable both as to its expression and its occurrence: It may be a mild reaction or extremely severe, actually sufficient to cause death, as, in fact, the writers saw in two instances, fortunately not among their own patients, when the drug induced a malignant leucopenia. It was, therefore, important that a careful watch be kept in order to detect as soon as possible the appearance of toxic reaction, thus allowing early adoption of counteracting measures. For the sake of brevity, the different toxic manifestations observed have been summarized in table 1. The patients have been divided into the groups already described above. Since only 8 of the 23 patients with secondary infection received treatment equal to or in excess of the specified dosage, it seems only fair to exclude from this tabulation the remainder of the group. Analysis of the data indicates that 98 individuals were studied for toxic reactions. Hyperpyrexia was the most common clinical symptom (12 patients), usually representing an elevation of 2 or 3°F. and occurring from 9 to 15 days after commencement of treatment. Upon withdrawal of sulfanilamide, the temperature was restored to

TABLE 1

DISTRIBUTION OF TOXIC MANIFESTATIONS OF SULFANILAMIDE

Variety of Trachoma	Number of Patients	Number of Patients Observed with					
		Fever	Headache	Rash	Cyanosis	Vertigo	Gastric pain
Uncomplicated							
Series 1	24	7	2	3	2	1	none
Series 2	24	none	4	1	none	none	1
Series 3	29	5	1	1	none	none	none
With secondary infection	8	none	none	none	none	none	none
"Flare-up"	13	none	4	none	none	1	none
Totals	98	12	11	5	2	2	1

normal, never requiring more than three days. Headache was the next most common complaint, occurring 11 times. This complication was of minor importance and was dissipated by discontinuation of the drug. A rash not unlike that seen in measles was encountered in five individuals appearing from 11 to 15 days after treatment was begun, with or without elevation of temperature. Again with immediate cessation of the drug this reaction subsided in one to three days. In addition, cyanosis occurred in 2 patients, dizziness in 2, and gastritis in 1, all promptly controlled by withholding further treatment.

It was not feasible to repeat blood examinations as frequently as desired, because many individuals (that is, in the group of secondary infection and "flare-up") were not carried sufficiently long on sulfanilamide, and other patients were not present at the time examinations were scheduled. In 35 individuals, however, it was possible to determine the occurrence of hematological variations attributable to sulfanilamide by study of the blood elements at least twice a week over the prescribed period of treatment. The data obtained from these patients are summarized in table 2. It will be seen that 25 patients showed no significant alterations in hemoglobin, or in the number of red blood cells. The changes observed in the remaining 10, while definite, were not considered of sufficient danger to warrant interruption of the treatment, although demanding greater alertness to avoid serious anemia. In the case of the white blood cells, 27 patients remained approximately normal and 8 gave distinct evidence of varying degrees of leucopenia with corresponding neutropenia. Of these 8, the condition became sufficiently marked in 3, so that treatment was discontinued before the reaction became alarming. The rule was followed scrupulously of abandoning sulfanilamide when the white cells reached a count of 3,000 per c.mm. Whether this number actually provides a sufficient margin of safety cannot be answered by the observation of the three examples encountered in this study.

The evidence indicates clearly that toxic reactions may occur frequently with the use of sulfanilamide. While

TABLE 2

FREQUENCY OF HEMATOLOGICAL CHANGES DURING TREATMENT WITH SULFANILAMIDE

Total number of patients observed	35
Number with depression in Hb.	10
Number with decrease in red cells	10
Number with decrease in white cells	8
Number with neutropenia	8

most of the manifestations are readily detected and of no great significance, others, as anemia and leucopenia, are more serious. It seems to the writers, however, that the danger from sulfanilamide is not in its potential toxicity, but rather in the negligence of the physician in charge. Ample warning of toxic reactions is usually provided by clinical alertness and frequent examinations of the blood, so that when the first signs of toxicity appear, the drug can and should be withdrawn immediately, thus checking further destructive action.

Discussion

That the treatment of trachoma has not yet attained a satisfactory state is evident from the frequent and numerous reports either modifying older methods or devising new procedures and preparations. While local application of metallic salts (silver, copper, and zinc) or grattage have long been established as perhaps the most reliable of the choices available, they nevertheless have their limitations, since such treatments are prolonged, painful, and scar-producing, and their end result is uncertain, as frequent recurrences attest. The introduction of sulfanilamide or its derivatives as new therapeutic agents for trachoma is a recent example of the efforts continually made to perfect the treatment of this disease. The marked success achieved with this drug among the Indians[4] prompted the present study to determine the effectiveness of sulfanilamide in trachoma.

A review of the collateral literature to date indicates a lack of unanimity on the action of sulfanilamide and related compounds in trachoma. The first report by Heinemann[1] while indicating successful treatment, is inadequate for analysis. One patient was treated with septacine, a benzyl derivative, and two with sulfanilamide, but there is no information supplied regarding dosage, duration of treatment, character of the disease, supplementary measures, and other data. The next published studies (by Lian[2] and Dik[3] indicate that sulfanilamide does not cause healing by itself, but, supplemented with local chemical or mechanical measures, it becomes an effective agent. Loe,[4] Gradle,[7] Kirk, McKelvie, and Hussein,[8] and most recently Richards, Forster, and Thygeson[9] have been greatly impressed by the curative effect of sulfanilamide. The latter workers observed the disappearance of inclusion bodies during treatment, and the inability of pooled tissues obtained from patients after 29 days under sulfanilamide to infect baboons, although there is no statement to indicate the infectivity of the tissues before treatment or the susceptibility of the animals. Applying a glucose derivative by subconjunctival injection, Burnet, Cuénod, and Nataf[10] concluded that this compound is more effective on the corneal than on the conjunctival disease.

Several other investigators take a somewhat intermediate position on the value of sulfanilamide in trachoma. While they acknowledge a certain measure of improvement and occasionally even recovery following the use of the drug, they hesitate to ascribe to it the degree of recuperative powers observed by the foregoing workers. These investigators are Hirschfelder,[11] Sedlacek and White,[12] Lane,[12] Spining,[13] and Trowbridge.[13]

Wilson,[14] on the other hand, treated with prontosil rubrum 10 children with primary trachoma, characterized by well-marked conjunctival lesions and minor corneal involvement (pannus tenuis and no active keratitis). He concluded that the drug had no effect upon the disease.

The data derived from this study impose upon the present writers a less sanguine attitude regarding the ap-

praisal of sulfanilamide. Sifting the results as described above, they may be summarized fairly (see table 3) as follows: in uncomplicated trachoma, improvement measured by numerical reduction, flattening, and blanching of follicles is common, but genuine recovery is infrequent; in concurrent conjunctival infection, the secondary condition is eliminated, and the trachomatous process may be improved, but its arrest is rare; in the exacerbative form, the effect of sulfanilamide is most striking, inducing complete regression of symptoms. In broad totals, irrespective of the classification devised in this study for convenience, trachoma was rendered asymptomatic in roughly 20 per cent of the patients, improved in about 40 percent, and unchanged in about 40 percent. It seems, therefore, that a large number of patients are improved but since they still remain clinically active they cannot be considered as arrested or asymptomatic. In other words, fuller treatment is required, and to this extent the results of Lian and Dik are confirmed by this study.

How much emphasis is to be laid upon the disappearance of epithelial-cell inclusions in the small number of patients (six) studied for the purpose remains doubtful in the writers' minds. The opinion formed from past experience is that inclusion bodies disappear automatically with the duration of the disease, that trachoma may be active and infectious for monkeys in their absence, and that mild treatment or repeated scraping of the conjunctiva frequently causes their evanescence. In other words, the mere absence of inclusions in a symptomatic conjunctiva cannot be interpreted infallibly in terms of clinical activity. So, as a matter of fact, only one of these six patients became asymptomatic, even though inclusions had disappeared in all. In the absence of clinical symptoms, on the other hand, the evidence for recovery appears to the writers to be self-sufficient.

Since going to press, two statements on the use of sulfanilamide have come to our attention. Busacca[15] states, " . . . in cases of trachoma and acute conjunctival catarrh, results obtained with sulfanilamide did not justify its further use."

TABLE 3

SUMMARY OF OBSERVATIONS ON TREATMENT OF TRACHOMA WITH SULFANILAMIDE

Variety of Trachoma	Number of Patients	Clinical Condition Following Treatment[1]		
		Unchanged	Improved	Arrested
Uncomplicated				
Series 1	24	3	17	4
Series 2	24[2]	2	19	3
Series 3	29[3]	24	4	1
With secondary infection	23[4]	15	8	none
"Flare-up"	13	none	none	13
Totals	113	44	48	21

[1] See text for greater details.
[2] The results indicated represent condition 1 month after treatment.
[3] Of these patients, 18 examined 3 months after treatment showed: unchanged 3, improved 14, arrested 1. At the end of 5 months, 16 patients remained, 8 were unchanged and 8 improved.
[4] Only 8 of this group received the full treatment or more, but not the same 8 indicated under improved; secondary infection was eradicated promptly in all.

Burnier[16] treated with this drug 15 patients with types II and III trachoma, but in conjunction with some other form of local treatment. Of these 3 were "apparently cured," one of whom received grattage and then silver nitrate simultaneously; 9 were improved (some had secondary infection), and 3 were unchanged.

Conclusions

1. Sulfanilamide administered in trachoma as described caused varying degrees of improvement in about 40 percent of the patients studied, and recovery in about 20 percent, without affecting the remainder.

2. The drug has a marked and rapid effect on the secondary infections commonly associated with trachoma.

3. The most striking results were observed in patients with exacerbative disease.

4. In a small number of patients studied (six), epithelial-cell inclusions disappeared during the course of treatment.

5. Sulfanilamide induces a variety of toxic manifestations, which need not be dangerous if care and judgment are exercised.

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LARVAL CONJUNCTIVITIS*

Report of a case due to Oestrus ovis

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Ocular myiasis due to the larva of the sheep gadfly is probably more frequent than a review of the literature indicates. Only five cases have been reported in the American literature, probably because the consequences are known not to be serious, or cases have been missed. Many have been reported in the French and Russian literature.

Stark,[1] Schenck,[2] Bedsdale and Neal,[3] Lyon,[4] and Mustard[5] describe an accidental eye infestation, with no serious ocular effects resulting.

The larvae found in all of the reported cases were similar. In none were the larvae reared to the adult fly stage, which it is not always possible to do. Thus in many cases of human myiasis the causative agent remains doubtful.

J. A. Portchinsky[6] first described the Oestrus ovis, its history, characteristics, methods of control, and relation to man.

The Oestrus ovis is the larva of the common sheep gadfly, which in its early larval stage, the stage found in the cases reported, reaches a size of about 1 mm. in length. It is oval in shape, broader in front than in the rear, with dark, well-developed hooks placed anteriorly. It is actively motile and uses its hooks for attachment to the mucous membrane.

The sheep gadfly is of interest in that it deposits its young while flying. It dashes into the eye or ear, deposits its larvae, and is away in a fraction of a second. It is one of the few flies that lay living larvae and not eggs.

During the summer or autumn the larvae, usually 5 to 50 at a time, are

Fig. 1 (Sniderman). Photomicrograph of Oestrus ovis; actual size 1 mm.**

* From the Department of Ophthalmology, Cincinnati General Hospital. Case reported before the Cincinnati Ophthalmology Society, October, 1938.

** The photograph was made by Mr. J. B. Homan.

deposited by the female flies into the eyes or nose of the sheep. The larvae pass into the sinuses, and during the winter grow into maggots that are 20 to 30 mm. in length. In the spring these maggots fall out of the nose onto the ground where they pupate in three to six weeks into the adult fly. This development has never been reported in man.

Larval conjunctivitis due to other fly larvae is met most commonly in Eastern Europe, Central America, and in the tropics. It may appear as conditions of varying seriousness, from the mildest, in which signs of irritation of the conjunctiva are found, to one in which a complete destruction of the eyeball by maggots is discovered. Its incidence is favored in humans by close association with infested animals and in living conditions of filth and squalor.

In all cases due to Oestrus ovis reported, the patients complained of itching, excessive lacrimation, and the usual signs of a mild conjunctivitis. Unless a careful examination is made, the causative factor may be missed. In the case to be reported, the patient insisted that there was something moving about in his eye, and only after examination with a binocular loupe were the larvae seen swimming about deeply in the folds of the conjunctival fornix. They might easily have been missed, hidden as they were in the folds. None was seen on the bulbar conjunctiva or on the cornea.

Case report. E. G., a white male, aged 42 years, a junk dealer, while working felt something hit his left eye. Five hours later he presented himself complaining of burning, excessive lacrimation, and "something in the eye."

Examination of the left eye revealed a superficial congestion of tarsal and bulbar conjunctiva. No foreign body was found. The cornea did not stain with fluorescein. The patient insisted that there was something in his eye and examination with a binocular loupe showed small wormlike organisms in the lower fornix. An attempt to wash them out of the sac was unsuccessful. Local anesthesia was instilled into the eye, and the organisms, hooked into the conjunctiva, were with difficulty removed by a cotton applicator. Fifteen of these larvae were removed at this time. They were about 1 mm. long. The microscopic appearance is seen in the photomicrograph.

A conjunctival smear at this time had only a few epithelial cells. There were no pus cells, bacteria, or eosinophiles. A white blood count and differential count was normal.

The conjunctiva was treated with a 2-percent solution of silver nitrate, and the patient given an antiseptic collyrium for home use.

On the second day the conjunctiva was moderately injected and edematous. Two more larvae were picked out of the conjunctival sac. This time they were inactive and easily removed.

On the third day the patient showed a slight morning agglutination of the lids. No larvae were found. By the sixth day the injection of the conjunctiva had cleared up and the patient was discharged.

One month later an ocular examination revealed nothing abnormal.

This case is reported because of its unusual nature and because the diagnosis might easily have been missed. It also emphasizes the importance of an examination of the eye under magnification, when the patient complains of a sensation as of a foreign body in the eye.

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STREPTOCOCCIC PSEUDOMEMBRANOUS CONJUNCTIVITIS TREATED WITH SULFANILAMIDE*

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Streptococcic pseudomembranous conjunctivitis may be acute or chronic. The chronic type of the disease may show exacerbations and remissions and therefore occasionally has been referred to as recurrent pseudomembranous conjunctivitis. Streptococci producing the beta (clear) type of hemolysis on blood agar may be isolated in pure culture or in association with other pathogenic bacteria. Specific passive immune therapy has been reported favorably by Kleuver[1] but these infections do not yield readily to the usual local treatment of conjunctivitis and often result in serious loss of vision. Systemic symptoms are common, and occasionally life may be endangered.

Three cases of streptococcic pseudomembranous conjunctivitis treated with sulfanilamide are reported. Each case represents a clinical type. Sulfanilamide administration to the first patient was begun in May, 1937, as a last resort to save the vision of a girl who had lost one eye in a previous attack of the disease. The encouraging results led to the use of the drug in the other patients.

*From the Department of Ophthalmology, College of Medicine, State University of Iowa. Part of a study being conducted under a grant from the Proctor Fund.

Case 1. The previous history of this patient, A. B., a 12-year-old girl, has been reported by Rutherford[2] and Kleuver.[1] The patient developed a severe unilateral pseudomembranous conjunctivitis which resulted in loss of the left eye[1] in 1932. Following removal of the globe a granuloma developed which persisted and was covered with pseudomembranes in each exacerbation of the disease. Five weeks after the enucleation of the left eye, the disease involved the right eye in association with acute glomerulonephritis. Streptococci were isolated periodically from the conjunctival sac. The condition progressed in spite of local measures including radiation therapy. Finally improvement resulted following the administration of scarlet-fever streptococcic antitoxin.[1] Active immunization with autogenous vaccine was attempted; however, the pseudomembranes recurred early in 1935. The inflammation was controlled by further administration of antitoxin and remained stationary for two years. In March, 1937, the patient developed an acute dacryocystitis on the right side which was treated successfully with irrigations and antitoxin. Active immunization with Dick scarlet-fever toxin was undertaken. In May, 1937, a

pseudomembrane reformed over the upper palpebral conjunctiva of the right eye. Scarlet-fever antitoxin was administered daily for two weeks, but the inflammation progressed. Oral sulfanilamide therapy (0.5 gr. per pound of body weight per day) was instituted. Three days later improvement became evident

Fig. 1 (Swan and Allen). Appearance of pseudomembranes in case 2 on admission.

and in 10 days all activity had subsided. The patient was advised to continue taking the same dosage of the drug at home, but did not do so regularly. On December 28, 1937, a pseudomembrane again appeared on the conjunctiva of the right upper lid, but the inflammatory reaction was less severe than in previous exacerbations. The patient remained in the hospital for two weeks in January, receiving the same dosage of sulfanilamide as on the previous admission. At the time of discharge, there was no evidence of active inflammation, and cultures remained negative. The patient has continued to take sulfanilamide (one-third grain per pound of body weight per day) for more than a year. There have been no toxic manifestations from the drug nor evidences of recurrence of the disease.

Case 2. G. S., an eight-months-old girl with an inflammation of the left eye, was admitted to the Eye Service of the University Hospitals on September 13, 1938.

In April, streptococci had been isolated from the baby's throat during the course of a severe upper respiratory infection.** Concurrently the infant had developed impetigo contagiosa, which had persisted.

On September 3, 1938, the left eye became reddened. Within 48 hours, the lids were swollen shut, and the margins were covered with a thick yellow discharge. The referring physician** reported that pseudomembranes developed on the third day, covering the conjunctiva of the upper lid. During the week before hospitalization, the swelling extended and involved the side of the infant's face. The discharge became increasingly profuse in spite of irrigations and local antiseptics.

Physical examination: On admission, the infant was pale and restless. Several of the typical flat erosions of impetigo contagiosa were present on the face. Otherwise general physical examination was negative.

The left cheek and eyelids were red and swollen. There was a seropurulent discharge which coagulated to form flat, yellow crusts on the cheek and along the lash line. The conjunctiva of the left eye was hyperemic, dull, and thickened. The fornices and plica semilunaris were edematous. A thin, grayish pseudomembrane was present over the tarsal plate of the upper lid (fig. 1). It was removed from the conjunctiva in one piece, leaving a few bleeding points. Small islands of pseudomembrane were present over the conjunctiva of the lower lid. These pseudomembranes re-formed in four to six hours after removal. Two-percent fluorescein produced superficial punctate staining of the cornea and patchy staining of the conjunctiva where pseudo-

** By Dr. H. C. Kleuver, Fort Dodge, Iowa.

membranes had been removed. The right eye did not show evidence of inflammation.

Laboratory: Smears of the discharge revealed large numbers of gram-positive cocci in pairs and short chains associated with masses of polymorphonuclear leucocytes.

Cultures were taken from the conjunctival sac. On blood agar, small semi-opaque colonies surrounded by zones of clear hemolysis were present 24 to 48 hours after incubation at 37°C. These organisms were not bile soluble and did not ferment inulin. In broth cultures, the organisms formed a flocculent sediment, smears from which revealed chains of gram-positive cocci.

Microscopically the pseudomembranes were found to consist of a fibrin network containing degenerated epithelial cells and leucocytes.

Urinalysis was negative. Hematologic studies are included in table 1.

Diagnosis: Acute pseudomembranous conjunctivitis due to beta hemolytic streptococci. Impetigo contagiosa.

Treatment and course: On September 14, 1938, sulfanilamide therapy was instituted by placing crushed tablets in the infant's formula. One-and-one-third grains per pound of body weight per day was prescribed, but because of frequent regurgitations and difficulty in feedings, the infant did not receive this full amount. Thirty-six hours later the discharge had decreased, no new pseudomembranes had formed, and cultures were negative. On the fourth day edema was negligible. Nine days after the beginning of treatment the only persisting sign of inflammation was slight hyperemia of the lid margins and conjunctiva. The course of the disease and the laboratory control of therapy are shown in table 1.

TABLE 1

TREATMENT AND COURSE IN CASE 2.

Date	Sulfanilamide		Cultures for Streptococci	Clinical Course		Total red cell count	Hb in grams	Total white cell count	Neutrophiles in white cell count
	Grains per lb. body wt. per day	Blood conc. in mgs. 100 c.c. blood		Pseudomembranes	Purulent discharge				
8/14/38	⅔	—	+	Re-formed 4–6 hours after removal	Profuse			26,250	68%
8/15/38	1⅓	—	+	Re-formed during night	Profuse	5,200,000	11.0	24,250	65%
8/16/38	1⅓	2.9	0	Absent	Moderate			22,150	49%
8/17/38	1⅓	—	0	Absent	Slight			15,800	52%
8/18/38	1⅓	2.9	0	Absent	Slight			21,400	36%
8/19/38	1⅓	—	0	Absent	Absent	4,900,000		21,150	38%
8/20/38	1⅓	2.8	0	Absent	Absent				
8/21/38	1⅓	—	0	Absent	Absent				
8/22/38	1⅓	—	0	Absent	Absent	5,100,000	10.6	16,400	40%
8/23/38	1	3.0	0	Absent	Absent				
10/25/38			0	Absent	Absent	5,100,000	10.5	14,300	36%

Case 3. G. S., a 47-year-old white female, noticed a foreign-body sensation in her right eye on the afternoon of November 2, 1938. On the following day this symptom was accompanied by photophobia and lacrimation. On November 4 a physician was consulted who cauterized a small corneal ulcer, instilled a mydriatic, and administered a foreign protein. The patient was subjectively improved, but on November 8th the eye began to ache, the lids became swollen, and a yellow discharge appeared. There were systemic symptoms including anorexia, weakness, and fever. The inflammation was treated in a local hospital with warm

compresses and irrigations. The discharge became thick and increasingly profuse, and on November 13th, the swelling spread to the right cheek. Three days later, as no improvement was evident, the patient was transferred to the University Hospitals.

Fig. 2 (Swan and Allen). Crusting and swelling of lids and cheek in case 3.

Past ocular history revealed that even with glasses her visual acuity had always been poor and seemed to be failing in recent years.

The patient had had frequent upper respiratory infections and attacks of redness, pain, and swelling of her joints each winter since 1930.

Physical examination: General examination revealed a pale, listless, poorly nourished, middle-aged arthritic, white female, with many loose and broken teeth, and a small erosion of the cervix uteri. Oral temperature was 99.8°F.

Examination of the right eye revealed a visual acuity of 1/200 which could not be improved. A red, encrusted swelling involved the eyelids and upper half of the right cheek (fig. 2). Hyperemia at the periphery of the lesion suggested an advancing border. A thick, yellow discharge was present along the lid margins. The conjunctiva was diffusely red, dull, and thickened. A gray tenacious pseudomembrane was removed intact from the conjunctiva of the upper tarsal plate, leaving multiple bleeding points. Corneal sensitivity was slightly diminished. An active pannus, most prominent superiorly, extended almost to the pupillary area. Small gray infiltrations were present in the anterior corneal stroma just within the limbus. Punctate superficial staining of the epithelium of the entire cornea was evident after the instillation of one drop of 2-percent fluorescein. Tyndall's phenomenon was present and a few circulating "floaters" were observed in the anterior chamber. The iris appeared normal. The pannus and a dense central posterior subcapsular cataract prevented satisfactory fundus examination. The intraocular tension was normal. The right preauricular node was enlarged and tender.

There was no inflammation of the left eye. Visual acuity was 3/200 but could be improved to 10/200. Visual impairment was attributed to a posterior subcapsular cataract and myopic degeneration of the retina.

Laboratory examination: Beta hemolytic streptococci were cultured from the conjunctiva of the right eye. These organisms had the same morphological and biochemical characteristics as those isolated from the patient in the second case. In addition many colonies of hemolytic Staphylococcus aureus were present.

Giemsa and Gram stains were made of secretion smears and of scrapings from the lower palpebral conjunctiva. Numerous polymorphonuclear neutrophilic leucocytes and a few eosinophilic leucocytes were found. The epithelial cells showed no evidence of inclusion bodies. There were many Gram-positive intra- and extracellular cocci. In hematoxylin-and-eosin stained sections (fig. 3) the membranes were seen to be composed of

a fibrin network in which polymorphonuclear leucocytes and the superficial layers of the epithelium were enmeshed. Necrosis of the enmeshed epithelial cells was evidenced by cloudiness of the cytoplasm and pale-staining nuclei.

The blood Wassermann test was negative, other hematologic studies are included in table 2; urinalysis was negative.

Roentgenograms revealed clouding of the right maxillary, frontal, and ethmoid sinuses.

Diagnosis: The primary diagnosis was acute pseudomembranous conjunctivitis of the right eye complicated by keratitis and cellulitis of the cheek due to a mixed streptococcic and staphylococcic infection. Secondary ocular diagnoses were high myopia with degenerative changes in the retina and bilateral posterior subcapsular cataracts.

Other diagnoses were secondary anemia, pyorrhea alveolaris, chronic sinusitis, endocervicitis, and atrophic arthritis.

Treatment and course: The treatment of this patient is given in detail in table 2. Oral administration of sulfanilamide was instituted on November 17, 1938. Improvement became manifest on November 19th by decrease in both discharge and swelling and by the failure of the pseudomembranes to re-form after removal. There was no growth of streptococci, although numerous colonies of staphylococci were present in the cultures for two more days. The amount of discharge and hyperemia was negligible after the fourth day of treatment, although a few colonies of staphylococci were evident in the daily cultures until the ninth day. The disappearance of staphylococci followed the institution of local antiseptic therapy to the conjunctival sac.

The course of treatment was complicated by an anemia which was present on admission and which gradually progressed during the period of sulfanilamide administration. The drug was discontinued when a mild leucopenia became evident. The anemia was treated by blood transfusion and reduced iron by mouth, with an uneventful recovery.

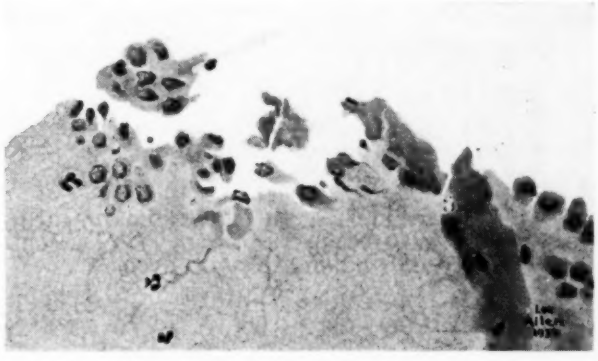

Fig. 3 (Swan and Allen). Section of pseudo-membrane showing polymorphonuclear leucocytes and epithelial cells enmeshed in fibrin network.

Discussion

Three cases of streptococcic pseudomembranous conjunctivitis were treated with sulfanilamide. All were serious infections that were progressing despite other forms of treatment. The first patient had lost an eye in a previous attack of the disease and attempts to build up specific active immunity had not been successful. The three patients represented different age groups and different types of the disease, but their clinical courses after institution of sulfanilamide therapy were similar. Signs of clinical improvement were evident after two to three days of treatment. There was a decrease in the amount of discharge, pseudomembranes did not re-form after removal, and cultures did not reveal the

TABLE 2

TREATMENT AND COURSE IN CASE 3

Date	Sulfanilamide		Cultures		Clinical Course			Hematology				Remarks
1938	Grains per lb. Body wt. per Day	Blood Conc. in mg. per 100 c.c.	Colonies of Strepto-cocci	Colonies of Staphy-lococci	Pseudo-mem-branes	Amount of Dis-charge	Hyper-emia and Edema	Hemo-globin in Grams	Total Red Cell Count	Total White Cell Count	Neutro-philes in White Cell Count percent	
11–16	0		Many	Many	Present	++++	++++	9.3	3,980,000	9,850	78	Sodium bicarbonate gr. V t.i.d. High caloric diet
17	1/3		Many	Many	Present	++++	++++					Cold compresses to cheek
18	1/3	5.5	Few	Many	Present	+++	+++					
19	2/3		0	Many	Did not re-form	++	++					Able to open lids
20	2/3	7.5	0	Few	Absent	+	+					
21	1/3		0	2	0	+	+		3,430,000	12,700	60	
22	1/2	5.1	0	0	0	+	+					
23	1/2		0	1	0	+	+					
24	0	6.1	0	1	0	+	+					Zephiran 1:2500 aqueous solution Gtts. i t.i.d. to O.D.
25	0		0	2	0	0	0		3,330,000	9,650	65	Slight pseudoptosis only persisting sign
26	1/3	3.5	0	0	0	0	0					White petrolatum to cheek cold compresses stopped
27	1/3		0	0	0	0	0		3,100,000	8,400		
28	1/4	5.7	0	0	0	0	0					
29	1/4		0	0	0	0	0	8.0	2,530,000	7,150		
30	1/4		0	0	0	0	0	7.45				Extraction of teeth. Reticulocyte count 0.2%
12–1		3.2			0	0	0	8.5	2,470,000	3,750	62	Rt. antrum irrigated
2					0	0	0					
3		Trace			0	0	0	8.5	2,540,000	4,750	41	
4					0	0	0					Reduced iron gr. V t.i.d.
7					0	0	0	11.5	2,580,000	6,700		Reticulocyte count 13%
8			0	0	0	0	0	12.0	3,390,000	7,400		600 c.c. blood transfusion
9					0	0	0					Reticulocyte count 9%
2-11-'39					No Evidence of Inflammation			11.5	4,040,000	6,100		

presence of streptococci thereafter.

The first patient had a mild recurrence of the disease seven months after treatment with sulfanilamide. This recurrence was controlled by further administration of the drug.

The maximum dosage of sulfanilamide (two-thirds grain per pound of body weight per day) administered to two of these patients was the minimum usually advocated in treatment of systemic infections. The blood concentration of sulfanilamide in the third patient was maintained at only 3 mg. per 100 c.c. of blood. The drug was administered in spaced doses and blood samples for analysis were drawn two hours after the late afternoon dose in order to determine the maximum concentration. The fluid intake was controlled to prevent excessive excretion or retention of the drug. Sodium bicarbonate was prescribed as a precaution against acidosis.

Conclusion

The oral administration of small doses of sulfanilamide was effective in the treatment of three cases of streptococcic pseudomembranous conjunctivitis. Further clinical trial is indicated.

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CONGENITAL SECONDARY GLAUCOMA*

Report of two cases syphilitic in origin

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Congenital (infantile) secondary glaucome is exceedingly rare, as stated by Ida Mann,[1] and she considers the increase in intraocular tension to be due to blocking of the pupil by adhesions between the iris and the lens. Fetal iritis occasionally develops a complete annular synechia, there is iris bombé with shallow anterior chamber, the tension rises, and the eye enlarges. Duke-Elder[2] intimates that inflammatory cells might block the drainage channels as in secondary glaucoma in adults. In such cases the uveitis, cyclitis, or choroiditis may have been prenatal.

Differential diagnosis

Congenital (infantile) primary glaucoma, buphthalmos, or hydrophthalmos, occurs fairly frequently, resembles glaucoma simplex in adults, and results from developmental abnormalities of the drainage mechanism in the iris angle. A. Fuchs[3] suggests that the term buphthalmos be applied to congenital glaucoma where the iris is incorporated with the bulging cornea, and that the term hydrophthalmos include those cases in which the iris is not included in the bulging cornea. However, buphthalmos, from the Greek words meaning ox eye, is the term most often used. In this condition the sclera and cornea stretch from the increased intraocular tension and produce an enlarged globe. The cornea is often clear, but there may be lines or striae produced by ruptures in Descemet's membrane. However, if the tension is sufficiently high the cornea will be steamy. The anterior chamber is usually deep, and the iris appears atrophic and may be tremulous from lack of contact with the lens. Heredity is considered to be an etiological factor. Buphthalmos is bilateral in about 80 percent of cases, and blindness is the rule unless surgical filtration is established. However, many cases have become arrested spontaneously.[4]

Megalocornea is a bilateral developmental anomaly in which there is no increase in intraocular pressure, but the entire anterior segment of the globe is larger than normal. The cornea is clear and transparent, and its diameter may be from 13 to 14 mm. The anterior chamber is always deep, the vision is usually good, and the cause of the enlargement is considered to be a primary overgrowth.[5]

Report of cases

The following two cases of glaucoma in infants illustrate a very rare complication of congenital syphilis; and because it seems to be caused by syphilis, the glaucoma is considered to be secondary in character.

Case 1. A colored male, W. A. G., aged 2 months, was referred to the eye clinic of Grady Hospital from the pediatric clinic on February 11, 1937, where it had been noticed that each cornea of the baby was cloudy and lusterless. The parents had brought the baby to the pediatric clinic for routine management. The general physical findings indicated congenital syphilis, and the blood Wassermann test was positive. Both mother and father had taken antisyphilitic treatment two or three years previously, although the mother's blood Wassermann was negative early in this pregnancy. This baby repre-

* From the Departments of Ophthalmology and Pediatrics, Emory University School of Medicine. Read before the Atlanta Eye, Ear, Nose, and Throat Society, February 12, 1939.

sented the third pregnancy, was delivered at full term, but weighed only 2,225 grams (4.9 lbs.). The first pregnancy in 1934 resulted in abortion at 5 months, and the second pregnancy ended in abortion at 6 months. There was no consanguinity.

The cornea of each eye was uniformly cloudy, as in acute glaucoma, that of the right eye being the most opaque. No cells were seen on the posterior surface of the cornea nor in the aqueous. The diameter of each cornea was thought to be normal, but unfortunately an actual measurement was not made. The anterior chamber appeared to be of normal depth. The pupils were 3 or 4 mm. in diameter, and only the left pupil reacted sluggishly to light. A faint fundus reflex was seen through the pupil of the left eye only. The intraocular tension was 90 mm. Hg in the right eye and 40 mm. in the left eye, as estimated under local anesthesia with the old Schiötz tonometer.

The case was considered to be one of early congenital primary glaucoma, or buphthalmos. One-percent pilocarpine solution was ordered to be instilled in each eye three times daily, and a sclerocorneal trephining was thought to be indicated if the tension was not reduced by miotics. A week later, on February 17th, the eyes were essentially unchanged and the baby was admitted to the hospital for an operation on the right eye. The pediatric department advised postponing the operation until a few weeks of antiluetic treatment had been given, but we considered the intraocular tension to be too high to be tolerated longer without loss of vision; and, too, we were of the opinion that the syphilis was not the cause of the glaucoma but only a coincidental disease. Under ether anesthesia, a sclerocorneal trephining of Elliot with a peripheral iridectomy was performed at about the 11-o'clock position on the limbus, by the resident surgeon. The postoperative recovery of the eyes was prompt and uneventful, except for a mild unexplained temperature for three days following the operation. The baby remained in the hospital for 10 days, during which time 1-percent atropine was instilled in the right eye once daily, and 1-percent pilocarpine was instilled in the left eye three times daily.

On February 25th, 90 mg. of sulpharsphenamine was given in the gluteal muscle, and the patient was dismissed from the hospital two days later, at which time the right eye showed only slight injection, the tension was normal as estimated by finger palpation, the cornea was clear, there was good filtration beneath the conjunctiva at the site of the operation, and the anterior chamber was of normal depth. The cornea of the left eye was slightly less steamy than on admission, and the intraocular tension was estimated to be one-plus by finger palpation. On the twelfth postoperative day all injection of the right globe had disappeared, and the intraocular tension was 24 mm. Hg in the right eye, and 28 mm. in the left eye. The left eye was normal externally. The baby received the second injection of sulpharsphenamine.

On the twenty-third postoperative day, when the third injection of sulpharsphenamine was given, both eyes appeared to be normal except for the trephining in the right eye. The baby received about 20 injections of arsenic and bismuth at varying intervals during the year following the operation, during which time the eyes remained normal.

The patient was next seen in the clinic approximately two years after the operation, and he was found to be a robust, well-developed, and well-nourished youngster. The external appearance of each eye was normal in every way, except for the presence of a small peripheral

iridectomy at the 11-o'clock position in the right eye. There was no subconjunctival filtration at the site of the trephination. The tension of each eye was normal, as estimated by finger palpation. The transverse diameter of each cornea was 11.5 mm., and the corneas were clear. The interior of each eye, including the discs, was normal in every respect.

Case 2. A three-weeks-old colored male, J. A. G., was also referred from the pediatric clinic of Grady Hospital to the eye clinic on February 21, 1938. The baby had been brought to the pediatric clinic for routine management, where it was observed by the pediatrician that the corneas were steamy and appeared to be slightly enlarged. There was no consanguinity, but both child and mother were known to be syphilitic. The intraocular tension of each eye was estimated as 4-plus by finger palpation. The corneas were equally and uniformly steamy, and appeared to be slightly increased in diameter, but an actual measurement of the diameters was not made. No cells were seen on the posterior surface of the cornea nor in the aqueous. The anterior chamber appeared to be of normal depth, the iris and pupils could be seen indistinctly, and the pupils were 2 or 3 mm. in diameter and reacted sluggishly to light. A fundus reflex could not be obtained.

The first case above reported was not recalled at this time, and again the diagnosis of congenital primary glaucoma, or buphthalmos, was made. One-percent pilocarpine solution was prescribed to be dropped in each eye morning, noon, and night, and 0.05 gm. of neoarsphenamine was given in the pediatric clinic. A trephining operation on one eye was advised to be performed on the next eye-surgery day one week later. However, when the baby returned for the operation, it was found that the corneas were much less steamy and that the intraocular tension of each eye was much reduced. The prescription for pilocarpine had been lost, and no miotic had been used. Then the first case was recalled, and it was decided to postpone an operation and continue antiluetic treatment. An intramuscular injection of bismuth was given in the pediatric clinic, and a week later the corneas were clear, and the intraocular tension of each eye was estimated to be normal by finger palpation. The patient received about 10 more injections of antisyphilitic treatment during the next seven months, during which time the eyes remained normal.

One year after the first visit, the child was seen in the home and found to be rather frail and slightly under weight, but otherwise well and playful. The external appearance of each eye and the fundi were normal. The intraocular tension of each eye was normal to finger palpation, and the horizontal diameter of each cornea was 11 mm.

Review of the literature

Only one similar case was found in the recent literature. Marquezy and Tavennec[6] reported bilateral glaucoma in a 22-months-old syphilitic child who also had left spasmodic hemiplegia, and whose spinal fluid gave a 4-plus Wassermann reaction. Antisyphilitic treatment and pilocarpine caused a rapid disappearance of the glaucoma. Four years later the eyes were normal, except that the discs were slightly pale. They quoted Mlle. Cordier who reported 12 cases of glaucoma in infants; only one was definitely luetic. She thought consanguinity might be a factor in nonluetic cases.

Beckh[7] made a statistical study of the incidence of syphilis in a group of 365 cases of primary glaucoma, and concluded that primary glaucoma in adults was in no way related to syphilis. He quoted Seefelder, who studied 47 cases of glaucoma in persons whose eyes were abnor-

mal from birth, and concluded that congenital syphilis did not play a role in the pathogenesis of buphthalmos. Beckh concurred with this opinion, because of the 11 patients in his series who had buphthalmos, on whom serologic studies were made, only one (a 17-year-old white girl) gave a positive Wassermann, and none had any stigmata of congenital syphilis.

Hardesty[8] reported a case of glaucoma in a 2-months-old baby, with a negative Wassermann reaction, in whose case he attributed an overactive thymus to be the cause of the glaucoma; he also reported a 1-year-old child, with a negative Wassermann reaction, in whom he thought the hypoactivity of the adrenals had caused the glaucoma. The first child's glaucoma disappeared promptly after X-ray therapy to the thymus gland, and the second cleared just as promptly when given one-eighth grain of ephedrine by mouth three times daily. The first patient was also given 1-percent pilocarpine in each eye twice daily, but the second did not receive a miotic. He reasoned that the hypoactivity of the adrenals in the second case was caused by an overactive thymus, and that by supplying the deficient ephedrine the overactive thymus was in turn suppressed. Hardesty also quoted Magitôt, who reported two cases of infantile glaucoma, in both of which operation for relief of the intraocular tension was followed by death a few hours later. Each case, he thought, suggested the so-called thymic death, that is, sudden death after a general anesthesia in an infant who had an overactive thymus.

Comment

One cannot with absolute certainty classify the glaucoma in these two cases. But when they were first seen there was very little injection of the globes, and in the absence of visible inflammatory cells in the anterior chamber it seemed logical to classify the glaucoma as primary in nature; especially since the consensus of opinion of the various authorities on the subject was that syphilis does not play a part in causing buphthalmos. The last factor was largely responsible for not postponing the operation in the first case until after more antisyphilitic treatment had been administered, as advised by the pediatricians.

The relief of the glaucoma could not be attributed to the use of miotics, because the second patient, through an error of the mother, did not receive a miotic. But the dramatic relief of the glaucoma by antisyphilitic treatment seems to point conclusively to syphilis as the etiology of the glaucoma in these cases. It is a well-established fact that intraocular syphilis usually manifests itself chiefly as an inflammation of the uveal tract and casts off inflammatory cells. These cells often block the drainage channels sufficiently to produce a rise in intraocular tension. In these cases there was probably a low-grade cyclitis which did not throw off enough cells to be visible macroscopically in the anterior chamber, but sufficient to block the iris angle and produce increased intraocular tension. For these reasons the cases were classified as secondary glaucoma.

I wish to acknowledge assistance of the members of the staff of the department of ophthalmology of the Emory University Division of Grady Hospital, and especially of Drs. William H. Kiser, Jr., Joseph Yampolsky, and M. Hines Roberts of the department of pediatrics for their help in the treatment and study of these cases.

Conclusion

When an infant has glaucoma, syphilis should be suspected; and when syphilis is present, an intensive course of antisyphilitic treatment should be given before ocular surgery is considered.

487 Peachtree Street.

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[4] Duke-Elder, W. S. Text-book of ophthalmology. St. Louis, The C. V. Mosby Company, 1938, v. 2, p. 1297.
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RETINAL ANGIOSPASM*

A CASE REPORT

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Chicago

Gradually failing vision over a period of two years had disturbed the patient, Miss D. R., a white woman aged 23 years. During the two months previous to her admission to the clinic the change had been particularly noticeable so that she was unable to carry on her work as a waitress. Associated frontal headaches had become very annoying but not incapacitating during the last two weeks of this period. A private physician made a tentative diagnosis of optic atrophy of unknown etiology and referred the patient to the Northwestern University Medical Clinics for consultation with Dr. Gifford.

On February 14, 1938, when she first reported to the Eye Clinic, her vision was R.E. 20/200 and Jaeger 7; L.E. 20/100 and Jaeger 4. A general examination in the preclinic department had revealed no abnormal findings and her blood pressure was 110/85. Her general appearance was that of a person in good health. The conjunctivae and corneae were normal. Muscle action in the nine cardinal positions was normal and no phorias were elicited with the cover test. The pupils reacted promptly to light and in accommodation. Both discs were of normal pinkness and had distinct outlines. No abnormalities of the peripheral fundi could be detected. The peripheral fields, taken on a Ferree-Rand perimeter with a 3-mm. white target, were normal. The central fields, taken on a Bjerrum screen, were tubular in type. In the right eye, the field for the 3-mm. object was only 5 degrees and with the 5-mm. object 10 degrees, with a very small field temporal to the blind spot. Color perception in this eye was lost. In the left eye, the field with the 1.0-mm. object was 5 degrees and with the 2-mm. object, 10 degrees. Perception of the red 8-mm. object was limited to the macular area. Diagnosis was deferred until the refraction could be tested.

Two days later, February 16, 1938, refraction was tested under homatropine cycloplegia, and the findings were R.E. +2.75 D. sph. ⌯ 0.25 D. cyl. ax. 135°; L.E. +2.50 D. sph. ⌯ 0.25 D. cyl. ax. 120°. At the trial test the R.E. ac-

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cepted +1.75 D. sph. and the left eye +1.50 D. sph. but the vision was ability to count fingers at three feet with the R.E. and 10/200 with the L.E. When the fundus was examined, a decided change from that of the two days previously was noted. The disc margins of the right eye were blurred on the nasal side and the entire disc was pinker than normal. The physiological cup was obliterated, but there was no elevation of the disc. The macular area was not swollen. The disc margin of the left eye was blurred, and the disc was slightly elevated. There was edema of the macula with formation of a faint star figure. A tentative diagnosis of neuromyelitis optica was made and the patient was immediately hospitalized.

A thorough physical examination, including a careful neurological study, disclosed nothing abnormal. During lumbar puncture the initial pressure was 120 mm. of mercury. Bilateral jugular pressure produced a rise to 230 mm. and release of pressure a steady fall to 130 mm. of mercury. The spinal fluid was clear, contained no cells, and gave negative Wassermann and Kahn reactions. The blood Wassermann and Kahn were negative. Sodium nitrite, gr. 1 three times a day, and vitamin B in large doses were prescribed. The patient was discharged from the hospital on March 1st, improved.

On her return to the clinic on March 7, 1938, her vision was R.E. 20/65 and Jaeger 7; L.E. 20/65 and Jaeger 4. The disc margins were still a little hazy, but the discs were of normal pinkness and the physiological cups had reappeared. No edema of either macula was noted, but a glistening reflex was obtained from both areas. Vasodilators and vitamin B were ordered continued.

On April 4, 1938, the patient felt that there was definite improvement, but objectively her vision was about the same: R.E. 20/65 and Jaeger 6; L.E. 20/65 and Jaeger 5; using both eyes, Jaeger 3 with difficulty. The peripheral fields were normal. With the Bjerrum screen the central fields were found to have remained tubular, and larger test objects had to be used than those of two months previously. In the right eye the field was 5 degrees with both the 5-mm. and 8-mm. white targets and there was no color perception in any portion of the field. In the left eye it was 10 degrees with a 3-mm. white target and 5 degrees with a 1-mm. Red perception with a 5-mm. target was limited to the macular region. Central scotoma could not be plotted with the smallest test objects. The patient always insisted that she could see the target in all portions of the field.

The inconsistencies of the field findings confused the diagnosis. The normal peripheral fields did not fit in with a diagnosis of optic atrophy and the almost tubular fields were more characteristic of a functional disturbance than of an organic one. The diagnosis was still undetermined.

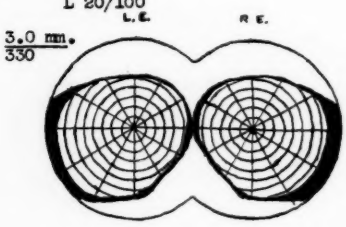
On April 11, 1938, the patient complained of feeling tired in spite of the fact that she was not working, was getting 10 to 12 hours of sleep per night, had an excellent appetite, and had been gaining weight. A general examination again revealed nothing abnormal. The blood count was red cells 4,600,000, hemoglobin 13.01 (Sahli) and white count 6,750. Her vision had improved to R.E. 20/65 and Jaeger 5; L.E. 20/65 and Jaeger 2. No abnormal fundus changes were observed.

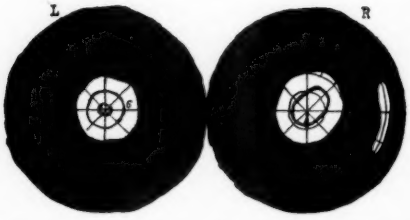
On May 2, 1938, her vision was about the same, but the right fundus appeared hazy, due to a slight cloudiness of the vitreous. Slight edema was present around the macula. The peripheral fields, taken with a 3-mm. target, were normal. On the tangent screen the field of the

CASE REPORT: RETINAL ANGIOSPASM

February 14, 1938

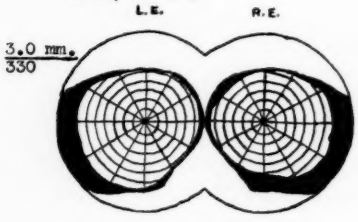
R 20/200
L 20/100





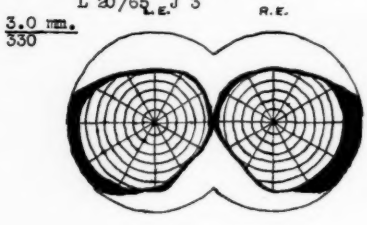
2.0 mm. and 1.0 mm./1000 White
8 mm. red
5.0 mm. white
3.0 mm./1000 white
No red perception

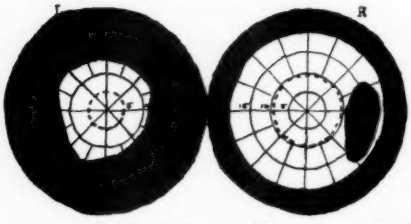
April 4, 1938
R 20/65 J 6
L 20/65 J 5



3.0 mm. and 1.0 mm./1000 white
5.0 mm. red
8.0 mm.
5.0 mm.
No color

May 2, 1938
R 20/65 J 6
L 20/65 J 3

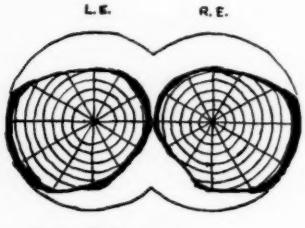




_____ 3, 2, 1.0 mm. white
------- 5.0 mm. white
_____ 10.0 mm. white
----- 5.0 mm. white

June 24, 1938

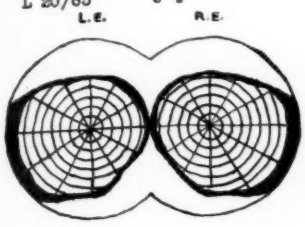
R 20/100
L 20/50-1



5 mm./330 mm.

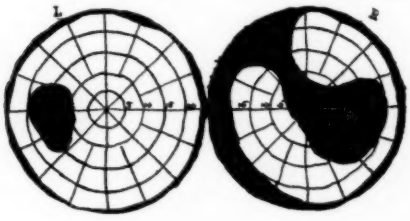
August 10, 1938

R 20/65 + 1 J 7
L 20/65 J 4



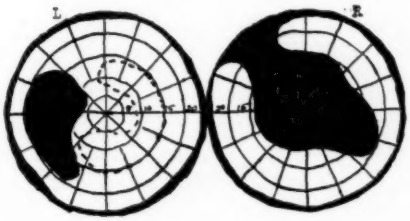
3 mm./ 330 mm.

5 mm./ 1000 mm. 15 mm./1000 mm.



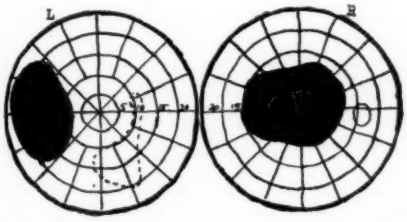
August 17, 1938.

———— 10.0 mm.
- - - - - - - - - 5.0 mm./1000 mm.



August 24, 1938

R 20/65 1 J 7
L 20/65 2 J

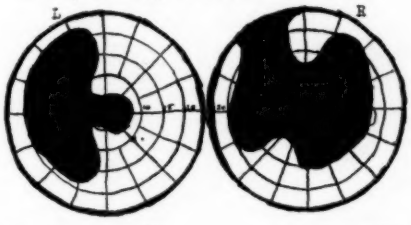


———— 10.0 mm.
- - - - - - - 5.0 mm./100 mm.

15.0 mm. /1000 mm.

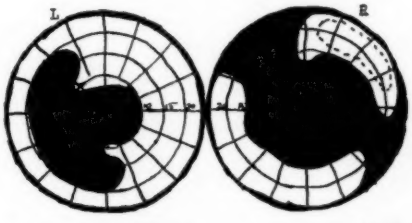
September 21, 1938

R Fingers at 2 feet
L 20/200 very blurred. No Jaeger



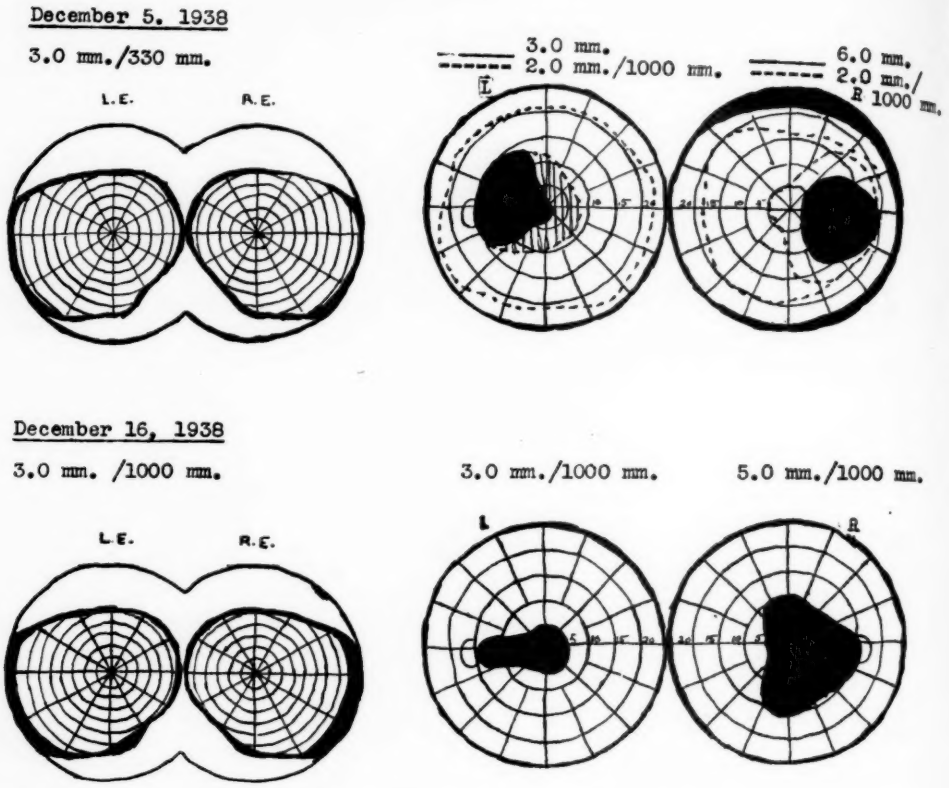
5.0 mm./1000 10.0 mm./1000 mm.

October 19, 1938



5.0 mm./1000 mm.

————— 15.0 mm.
- - - - - - - - - 10.0 mm./1000 mm.



right eye, with a 10-mm. white target, was 20 degrees and with a 5-mm., was 10 degrees. The blind spot was four times the normal size. The patient's responses were not consistent, because she could see the 5-mm. target before the use of the 10-mm. but not afterward. In the left eye the field for 3-mm. was 12 degrees and for the 2-mm. and 1-mm., 5 degrees.

On May 9, 1938, the fundi had returned to normal. On the 12th, a basal metabolic test was ±0, and on the day following, the patient was reëxamined by her private physician, who found nothing abnormal. Her blood pressure was in the lower range of normal.

The patient had a head cold on June 1, 1938, and complained of a severe frontal headache. Her vision was R.E. 20/65, L.E. 20/40, and Jaeger 5 both eyes, the best vision she had obtained in some time. The frontal sinuses were absent and the remainder were clear. A diagnosis of chronic nasopharyngitis was made by the attending physician of the ear, nose, and throat department.

On June 24th the vision was R.E. 20/100 and L.E. 20/50. The disc of the right eye was pale, and peculiar vertical light reflexes passed through the macular area. No swelling was noted. The peripheral fields were abnormal and no central fields were recorded.

From this time until July 6th, the patient felt very well. Vision remained the same. Slight paleness of the temporal half of the disc of the right eye was noted. Dr. Gifford considered that the peripheral vessels, particularly on the nasal side of the right disc, were narrower than normal and somewhat spastic The patient was referred to the Vascular Clinic where a special study was being conducted on peripheral vascular conditions by Dr. Gilbert H. Marquardt. The

patient was found to have extreme spasticity of the peripheral vessels of the fingers and toes and a blood pressure in the lower range of normal. She was placed on theoaminol, a vasodilator. A neurological examination at this time disclosed nothing abnormal.

On August 10, 1938 her vision was R.E. 20/65 and Jaeger 7; L.E. 20/65 and Jaeger 4. With the right eye a 15-mm. white target was the smallest that the patient could perceive. The blind spot was enlarged and joined with a large scotoma of the central field, extending out to the 5-degree isopter and to the periphery between the meridians at the 10- and 12-o'clock positions. A 5-mm. target was the smallest that the left eye could perceive. The blind spot was about four times its normal size and no scotoma could be plotted. No change in the fundi was noted.

A week later her vision was the same. The scotoma of the right eye remained about the same, but the blind spot of the left eye had increased in size and was extending towards the macula and inferiorly. A slight veiling of the disc margin of the right eye was seen. Radial folds extended from the macula, giving the area a wavy appearance and were due probably to irregular swelling of the internal limiting membrane. There were similar changes in the left macula and the arteries throughout the fundus were narrowed.

On August 31st, Miss R. complained of a pounding headache in the frontal area, of a week's duration. It was present when she arose in the morning, persisted all day, but did not prevent sleep at night. Shifting the position of the head did not alter the discomfort. Her vision had dropped to R.E. 20/200 and no Jaeger; L.E. 20/200 and Jaeger 7. The scotoma with the 10-mm. white target remained the same, but the field for the 5-mm. in the left eye was definitely smaller. Both disc margins were blurred and the central portion of the discs was swollen so that the physiological cups were obliterated. Fine pigment dust was seen in the periphery of both fundi for the first time. It was particularly dense in the inferior portion of each fundus. The patient was again hospitalized.

A complete physical examination, including a careful neurological, revealed nothing abnormal. The spinal puncture was repeated, and the pressure and the fluid were normal. Four typhoid injections at three-day intervals were given intravenously, the first 30 million and the last three 50 million. The patient had good temperature reactions. On her discharge from the hospital her vision was R.E. 20/100 and no Jaeger; L.E. 20/65 and Jaeger 5.

On September 16th, a slight congestion of the nose, nasopharynx, and pharynx was found. The sinuses transilluminated well. The X-ray report stated that the frontal sinuses were congenitally absent, the ethmoid cells on either side were slightly hazy, the left antrum was not so translucent as the right, and the outlines of the right were hazy. The sphenoid sinuses and sella turcica were normal. On September 23d, the clinicians of the nose and throat department considered the sinuses clear.

October 13, 1938. The patient had had an abscessed tooth removed the previous day and was having a severe general reaction. Her vision was R.E. 1/200, L.E. 20/200 and no Jaeger. The discs had a peculiar pale-yellow cast, not a true pallor, and the disc margins were sharp. There was a silvery sheen to both maculae but no swelling, and the arteries remained narrow. The extreme periphery of both fundi had a faintly mottled appearance. The patient was advised to rest until her recovery from the tooth extraction and then return.

On October 19th, the patient's vision

was R.E. 8/200 and L.E. 20/200; no Jaeger. Both right and left scotomas had increased markedly in size. Throughout this period of study arachnoiditis had been considered as an etiological factor, but no localizing symptoms or characteristic fields could be discovered. Since the only causative factor present seemed to be the marked vascular spasm, cervical sympathectomy was considered the logical procedure. An intracranial operation appeared much too radical on the basis of the findings. Dr. Gifford advised that the patient be hospitalized and cervical sympathectomy performed.

Her blood pressure on admission to the hospital was 80/60. In spite of this, the marked vascular spasm persisted. Dr. Gifford noted that the arteries of the right eye were threadlike, much more spastic than at any previous examination. No neurological changes could be found. Typhoid injections and vasodilators gave no improvement. A cervical sympathectomy was done on the left side on November 2, 1938, and on the right side on November 11th. Her recovery was uneventful.

On discharge from the hospital, November 30, 1938, her vision was R.E. 5/200 and no Jaeger; L.E. 20/100 and Jaeger 7 at 10 inches. The right scotoma had disappeared, and only an enlarged blind spot remained, upon using a 6-mm. and 2-mm. white target. From the vision it would seem that a small central scotoma should be present, but poor fixation probably accounted for the inability to plot it. The left blind spot was enlarged and, using a 2-mm. object, was found to be joined to a small central scotoma. The peripheral fields remained normal.

On December 5, 1938, vision in the right eye was 20/200, in the left, 20/65 and Jaeger 7. With the pupils dilated with 2-percent homatropine hydrobromide, the arteries in the right eye, particularly the peripheral and macular vessels, were found to be noticeably larger and almost normal in caliber. Vessels of the left eye were still slightly spastic and less improvement was seen than in the right. The maculae appeared to be normal. Both discs had well-defined margins and were of normal color.

The patient is to be studied further in the clinic.

Discussion

The confusing and apparently inconsistent findings in this case caused difficulties in arriving at a diagnosis. The changing fundus picture and the loss of central vision forced the discarding of a diagnosis of a functional disturbance even though the fields during the first few months were so characteristic of this condition. Multiple sclerosis, which often presents bizarre symptoms and objective findings, would seem to be excluded since no other signs of the condition have been found in the year of observation in the clinic nor previously while under the care of a private physician. No localizing symptoms, X-ray findings, nor fields characteristic of any type of intracranial lesion have been noted. The basal metabolism was normal, as was the menstrual cycle, which would indicate a normal glandular balance.

The only etiology for the symptoms and findings in this case is the retinal angiospasm, which is part of a generalized spastic condition of all of the peripheral vessels. This spasticity persists in spite of a low blood pressure which seems to be a part of this clinical picture. After a known duration of one year of the condition, the discs are still of normal color and show no signs of optic atrophy. The patient's visual difficulties, as well as her general exhaustion, can be explained on this vascular basis.

25 East Washington Street.

NOTES, CASES, INSTRUMENTS

MELANOSARCOMA OF THE CILIARY BODY AND IRIS

Report of a case

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Mortality in ophthalmology is largely dependent on the incidence of malignant tumor, especially melanosarcoma. Frequency of this condition is difficult to determine. Mortality statistics are published by the various health departments in tables with limited detail. International nomenclature of causes of death is followed. The common malignancies of general organs are listed separately; however, others are grouped together in the category "Cancer of other unspecified organs." This group includes all malignancies of the eye, muscles, lymph glands, and several other organs as well as cases in which the organ primarily affected was not determined. No classification of the malignancies of the eye nor separation of retinoblastoma from melanosarcoma could be found. We studied the available statistical reports and wrote to many cities and states throughout the country, but none classified their ocular malignancies separately. The foreign statistics are no more illuminating. New York City Health Department, in a special report compiled for 1935 to 1938, listed 58 deaths due to malignancies of the eye for the white population of 7,010,841; an annual rate of 2.76 per million. This included all malignancies of the eye. Records of the New York Eye and Ear Infirmary showed that two thirds of the ocular malignancies were melanosarcomas. We can, therefore, estimate a death rate for melanosarcoma of the eye of 1.84 per million for the white population each year. We can compute from this that, in the United States, at least 220 white people die each year from melanosarcoma of the eye. The total number of cases must be higher, for these figures are only for fatal cases and do not account for those cured or undiagnosed. The late appearance of metastases causes a delayed mortality and makes an accurate check impossible.

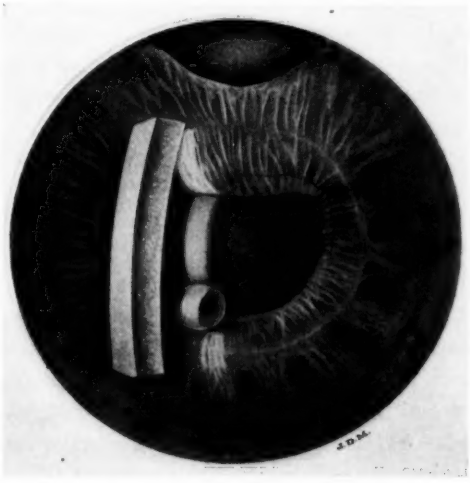

Fig. 1 (Agatston and Gartner). Melanosarcoma of ciliary body and iris.

Few figures are available for the death rate of those affected with melanosarcoma. Nathanson and Welch in 1937 studied 128 cases and found a five-year death rate of 67.5 percent and a six-year death rate of 75 percent.

Even at the large clinics few cases of melanosarcoma are seen. At the New York Eye and Ear Infirmary, from 1935 to 1938, there were 70,000 clinic patients with 11 cases of melanosarcoma. Terry and Johns in 1935 reported that at the Massachusetts Eye and Ear Infirmary melanosarcoma was found in one out of every 2,000 patients in their clinic. Stallard, reporting the statistics of Moorfield's

Eye Hospital in London from 1925 to 1931, found one out of every 4,000 patients had melanosarcoma.

The occurrence of melanosarcoma of the ciliary body is still rarer. Investigations of Lawford and Collins in 1891 and Kronenberg in 1938 showed that the ciliary body was affected in 2 to 6 percent of the cases.

The studies show melanosarcoma does not favor any portion of the uveal tract. Its relative frequency in the choroid, ciliary body, and iris is about proportional to the amount of uveal tissue contained. This is further borne out by the location of tumors in the choroid. Over 75 percent of the tumors occur in the posterior segment where the choroid is thickest. Anteriorly, where the choroid is thin, fewer tumors develop.

Seven hundred and fifty-five cases were collected from various sources in the literature. Four hundred and twenty-one were in males, 334 in females, an incidence of 56 percent for males, and 44 percent for females. In 550 cases the ages were available; few of the patients were under 10, and the greatest number were between 40 and 60 years of age. The average age of those with melanosarcoma of the iris was 35 years, while that of those with involvement of the choroid and ciliary body was 47 years.

Melanin is normally present in the skin, the pigmented epithelial layer, and the uveal tract. In Negroes it is most abundant. It is rather striking that melanosarcoma is exceedingly rare in the Negro. The statistics of the New York City Board of Health show that from 1935 to 1938 in a colored population of 423,505 there were no deaths due to malignancies of the eye. As noted previously the white population had an incidence of approximately 2.76 per million per year. Matas in 1896 drew attention to the rarity of melanosarcoma in the Negro. This was confirmed by Bishop in 1932 in a study of its incidence at the Emory University Division of the Grady Municipal Hospital at Atlanta, Georgia, for colored patients. From 1921 to 1931, there were 956 cases with tumors of various types. Only one was melanosarcoma. Quinland in 1936 reported that on a large Negro service, he had seen three cases of melansarcoma of the skin, none of the eye. In the recent edition of MacCallum's Pathology, an observation was made that melanoma is common in white and gray horses, but has not been found in black horses.

The origin of melanosarcoma has not been determined. Von Recklinghausen claimed they arose from endothelium. Krompecher claimed epithelial origin. A study by Ribbert in 1911 indicated that the pigmented cells were mesodermal and developed from chromatophores.

Dawson, in 1925, made an exhaustive study of melanoma and suggested that the pigmented cells in the uveal tract came from the pigmented epithelium cells which wandered into the uvea in embryo.

Mann pointed out the dominance of the pigment epithelium over the development of the choroid. Only where the pigment epithelium is present does choroid develop.

Masson in 1931 demonstrated a neuroectodermal origin of nevi and melanosarcoma of the skin. He showed an association of these growths with terminal end organs of the sensory nerves. The occurrence of similar melanomas in the skin and conjunctiva indicates an ectodermal origin. The ectodermal origin of uveal melanosarcoma appears probable, though not absolutely proved. Thus, the classification of these tumors as sarcomas is questionable. Malignant melanoma appears to be a more suitable term.

The morphology of the tumor cells is variable. Some are round cells, some spindle, some polyhedral. Pigmentation of

the cells is usual. Callender in 1931 and 1935 made a careful study of the morphology and staining characteristics. He classified them into spindle cells with subtype A and B, fascicular type, epithelial type, and mixed type. The spindle cells end in fibers resembling fibroblasts. Subtype A has a nucleus with delicate reticular structure in which nucleolar material is not well defined. Subtype B has a nucleus with a coarse network and a sharply defined, deeply stained, small, round nucleolus. The fascicular-type cells are elongated, sometimes with fiberlike structures, but rounded and polygonal shapes are seen. The majority of the cells are arranged in fasciculi or columns. The cells in the column radiate about a center, which is a lymphatic or capillary blood vessel. The epithelioid type are polygonal cells of relatively large size. The mixed-cell type contains an irregular mixture of spindle and epithelioid types of cells with occasional areas of fascicular type.

The lowest mortality was found in subtype A of spindle cells. Of the others, the worst was the mixed-cell type. In 1935 Callender and Wilder described staining methods with silver salts which aided in evaluation of the degree of malignancy.

On account of the numerous variations, errors in diagnosis are common. The typical course has been described by Fuchs in four classical stages. In the first, the growth is localized in the eye and retinal detachment occurs. In the second, congestive glaucoma develops. The third is marked by perforation of the globe and orbital extension. The fourth corresponds to metastases, especially to the liver. Glaucoma may be the first sign.

Necrosis of the tumor often occurs and confuses the clinical picture. Samuels examined 106 cases of melanosarcoma, of which 31 were necrotic. Of the 31 cases with necrosis, an erroneous diagnosis was made in 20, mainly of glaucoma. Samuels called attention to iridocyclitis with a chocolate-colored exudate in the anterior chamber, and the additional appearance of scleritis as signs of necrosis.

Terry and Johns in their series of 94 cases from Massachusetts Eye and Ear Infirmary reported that in 42 cases an erroneous diagnosis of glaucoma, retinal detachment, cataract, uveitis, and opaque cornea was made.

Early in its development, melanosarcoma of the ciliary body gives no symptoms and cannot be seen. Symptoms are manifest later than in tumor of the choroid. Early symptoms are change of refraction and loss of accommodation. This is easily overlooked. Subluxation of the lens, or an opacity of the lens may be an early sign. Later, the iris becomes displaced, it protrudes into the anterior chamber, and the pupil becomes distorted. As the growth progresses the tumor may be visible at the angle and appear as a dark crescent at the root of the iris, simulating iridodialysis. Transillumination, however, is positive. The superficial blood vessels over the tumor become engorged and are readily seen. This vascular engorgement has a diagnostic significance.

Retinal detachment occurs later in melanosarcoma of the ciliary body than in that of the choroid, which accounts for delay of subjective scotoma.

In melanosarcoma of the ciliary body, glaucoma occurs only occasionally. Terry and Johns in 1935 found that 28 percent of their cases of ciliary-body tumors were associated with glaucoma, while 47 percent of the choroidal cases presented this association. Dunnington in 1938 reported a series in which 12.5 percent of cases with ciliary-body tumors presented glaucoma, while in 29.8 percent of those with choroidal growths glaucoma occurred.

According to studies of Denecke in

1936, the mortality of melanosarcoma of the ciliary body is higher than that of the choroid or iris. Other reports seem to corroborate this. Samuels in 1933 states that tumors that reach the angle are particularly dangerous to life because of their tendency to invade Schlemm's canal and the anterior ciliary vessels. In our case this invasion is clearly demonstrable. This fact together with late recognition is the cause of higher mortality of melanosarcoma of the ciliary body.

Melanosarcoma of the iris is rare. Rosenbaum in 1938 reported a case in which a yellow-brown spot, apparently congenital, developed into a melanosarcoma. Many iris tumors have been watched for years before they were removed. Mayou in 1930 reported a melanosarcoma of the iris observed 13 years before enucleation. Chance in 1928 reported a sarcoma present 27 years before enucleation.

Melanosarcoma of the skin is easy of observation. Many develop from nevi which remained unchanged for years. Others start without any apparent nevi. Growth is usually very slow at first. After months, in many cases after years, the rate of growth is accelerated. Metastases usually develop after many years.

Most probably the melanosarcoma of the ciliary body and choroid follows a similar course. Since early recognition is difficult, it may be of several years' duration when first noted. Metastases are also late manifestations.

Sympathetic ophthalmia as a complication has been reported in a few cases. An intraocular operation, such as iridectomy for relief of glaucoma, is a likely factor. In one of Samuels's cases there was evidence of an old injury at the limbus in addition to the tumor. Terry and Johns reported a case of sympathetic ophthalmia with melanosarcoma that had perforated the globe. A few rare cases were reported by Fuchs and by Samuels, in which sympathetic ophthalmia apparently developed in a globe not operated upon and not perforated.

X-ray and radium therapy for melanosarcoma of the eye have been tried. Janeway in 1920 treated three cases with radiation, but there were recurrences in all. Birch-Hirschfeld in 1922 treated a case with apparent improvement, but later acute glaucoma set in, and the eye had to be enucleated. Section showed necrosis with some active sarcoma cells. Parker and Stokes in 1926 reported a case in which the neoplasm seemed to shrink after radium. Stallard in 1932, after exhaustive study, found no authentic cure of melanosarcoma of the eye by X ray or radium.

In removing melanosarcoma of the skin, wide excision of neighboring tissue and its area of lymphatic drainage seemed to prevent recurrence.

In melanosarcoma of the eye, the usual operation has been a simple enucleation. In some cases, after local recurrence, exenteration is performed. The latter is probably more palliative than curative.

Case Report. S. B., white, a housewife, aged 27 years, presented herself at the New York Eye and Ear Infirmary, on October 12, 1938.

Several months previously, she had first noticed a change in the appearance of the pupil of the left eye, but paid no special attention to it. She suddenly became aware of defective vision in this eye on the day before her visit. Her past history and that of her family were essentially negative. Vision had always been good.

Vision was O.D. 20/30; O.S. 20/70. The right eye was apparently normal, with clear media and normal hyperopic fundus. The left eye presented normal lids and conjunctiva. Radiating from the limbus at the 12-o'clock position there

was an area of paracorneal injection. The cornea was clear; the slitlamp examination, negative. The anterior chamber was shallow, much shallower above than below. There was a displacement of the pupil downward. The outline was irregular. At the upper margin, an irregular, dark-brown mass was seen between the iris and the lens. The upper half of the iris bulged forward, almost in contact with the cornea; its upper border showed a dark crescent simulating iridodialysis. In the pupillary area a small cyst was visible. The lens was clear. The vitreous was hazy with dustlike opacities. The fundus could not be clearly seen but did not seem to be pathological.

The tension was O.D. 18 mm. Hg. (Schiötz), O.S. 20 mm. The field of vision was normal for the right eye; the left presented a large defect below and temporal, almost to the fixation point.

By transillumination, the right eye was negative. In the left eye a positive shadow was seen above.

Diagnosis: Melanosarcoma of the ciliary body.

The physical examination was negative; there were no metastases, nor was there any melanin in the urine. The Wassermann reaction was negative.

Treatment: On October 19, 1938, the left eye was enucleated. The pathological report by Dr. Bernard Samuels corroborated the diagnosis.

Summary

A study of melanosarcoma was made, special attention being given to involvemen of the ciliary body and iris. A typical case is reported.

Melanosarcoma of the ciliary body is especially characterized by a greater obscurity and delay in symptoms and diagnosis. Retinal detachment occurs late, glaucoma is less frequent, and the mortality is higher than in cases of melanosarcoma of the choroid or iris.

Tumors primary in the iris are recognized earliest and have the lowest mortality.

Melanoma seems rare in the Negro.

A study of these tumors indicated that their origin from neuroectoderm is probable.

Malignant melanoma seems to be a more suitable term than melanosarcoma.

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A NEW SURGICAL TECHNIQUE FOR DACRYOCYSTITIS

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Because of the difficulties to be overcome in the treatment of dacryocystitis, and because of the uncertain results, numerous procedures have been recommended for its cure. Apparently, no method nor technique presented to date has been uniformly successful. For this reason a technique that has proved eminently satisfactory in the writer's hands is herewith presented, and in the same connection attention is called to some of the reasons why some of the so-called standard methods have resulted in failure.

Just a word regarding the physiology of the lacrimal apparatus. The tears are directed toward the inner canthus principally by the motion of the lids. Within the lacrimal bay the tears are sucked up by the puncta, which must be in constant contact with the eyeball so that this may take place. This sucking force is supplied by a very essential mechanism—the lacrimal canaliculi surrounded by Horner's muscle. The action is similar to that produced by the hand in milking a cow. In milking, however, the hand expels the milk, whereas in this mechanism, the spiral Horner's muscle acts to suck up the tears and empty them into the lacrimal sac, whence they are carried to the nose by gravity and by the nasal respiratory act. By the act of inhaling, the valve at the nasal terminus of the duct opens, and the contents are drawn into the nares.

Now any line of treatment for correcting epiphora or dacryocystitis that does not fully consider the importance of the puncta or destroys the function of the spiral muscular fibers of Horner and the canaliculus (Norris-Oliver, v. 1, p. 93) or disregards the plica lacrimalis results in failure. In former years the writer performed the classical operation, slitting the canaliculus until a large probe could be passed directly through the sac and into the nose. Yet there was always disappointment when the lacrimal function was not restored, and when dacryocys-

titis persisted. The writer has seen many patients who have been operated upon in this manner, but epiphora or, as the case may be, dacryocystitis has remained—patients operated on for the removal of the infected sac, or by whom a silver tube has been worn for years, neither method yielding success. Epiphora still remains to the discomfort of the patient. Surgery to create a new and more direct communication with the nasal chamber by an artificial finestrum has not produced the desired results and leaves too great a possibility for ocular infection from the nasal cavity. Failure, by these methods, has resulted because the most essential elements in carrying off the tears have been overlooked or disregarded.

For years, realizing that the full preservation of this function is most necessary, the writer has followed a procedure that does not materially harm the function of the punctum nor of the canaliculus. The technique consists, first, in the manner of incising the punctum and canaliculus, and, second, in the manner of the incisions of the plica lacrimalis.

In the classical operation (Fuchs, ed. 3, p. 603; De Schweinitz, ed. 3, p. 661) in slitting the punctum, we are instructed "to have the cutting edge of the knife upward and slightly backward, and to pass the knife horizontally until the bulbous point enters the upper end of the sac." By this movement the roof of the canaliculus is slit to the entrance of the sac.

Technique

First step: This procedure differs from the classical one in several very important points. After the tip of the lacrimal knife has entered the lower punctum, and while the knife is being brought to a horizontal position, instead of having its cutting edge directed upward and slightly backward, the edge is directed *downward* and slightly *forward,* so that the cutting is entirely *within the lid.* The bulbous tip of the knife follows the canaliculus. When the tip of the knife enters the upper end of the sac, its handle is elevated to a perpendicular position and it passes downward. By this procedure, the punctum and the canaliculus are made large enough to admit a no. 8 or 10 Theobald probe, or a silver or other pliable syringe tip. An operation by this technique leaves the functions of the punctum and of the canaliculus unharmed, as the severed muscular fibers of the punctum and the canaliculus reunite; but an easy access is given to the sac since the punctum and the canaliculus remain somewhat enlarged. Probing should follow at frequent intervals (every five or six days). Caution: The knife must be withdrawn with the cutting edge outward in the same position as it entered the sac, so that but one incision is made.

Of course it is still necessary to carry on treatment as indicated for the cure of the infected sac. Sounds, antiseptic irrigation and like measures are still necessary. Having established a means of reaching the sac, the operator is enabled to carry on these treatments more easily and successfully.

Second step: After incising the floor of the canaliculus and entering the sac the lacrimal knife is passed on down through the nasolacrimal duct into the nose, great care being taken as to the position of the cutting edge of the knife. The cutting edge should first be directed forward as it passes downward to enter the nasal cavity in a plane parallel to the outer wall of the nose, then drawn back into the sac and turned so that the cutting edge is backward, and again passed downward into the nasal cavity. In this manner, adhesions at either angle of the valve-flap (plica lacrimalis) are freed. To pass the knife into the nasal cavity with the

cutting edge directed inward may actually be harmful. Indiscriminate cutting may result in such injury to this valve that the patient in blowing the nose will cause the discharge to pass through the duct and the sac into the eye, thereby endangering the latter. In performing this operation it is necessary also to use a delicate, straight canaliculus knife with a fine probe point, such as Weber's or Agnew's. Irrigation should be done with a lacrimal syringe having a probe-pointed tip.

Numerous cases could be cited of simple noninfected obstruction of the lacrimal drainage and also of infected suppurative conditions. The following case will suffice to show the results from the technique employed:

Mrs. N., a woman in her late thirties, had been suffering from dacryocystitis for many years. In her case dacryocystitis had developed finally into a cystic abscess that was continually rupturing and draining on the face. Under the care of good ophthalmic surgeons her condition would improve, only to relapse after a brief period, and never reaching the point where it was entirely satisfactory. The patient consulted the writer on January 17, 1937. She had an abscess of the right sac that was almost ready to break.

Operation: The abscess was incised directly into the sac, the pus washed out with an antiseptic solution, and the cavity wiped with a 5-percent silver-nitrate solution. After the acute condition had subsided (February 7, 1937), the method described above was followed. The patient returned for treatment on January 18, 20, 25, 27; February 7, 12, 18, 20; March 3, 5, 16, 19, 25; April 3, 19; May 1, 22; July 24, and on September 4. These dates are cited to show how few treatments were required to clear up a chronic condition—from January to May. The patient was asked to report in May, July, and September in order that a check might be kept on her condition. At these three last calls there was no evidence of infection, no epiphora, and no evidence of the surgical interference, save a slight scar where the abscess had been incised.

Argyle Building.

SOCIETY PROCEEDINGS

Edited by Dr. H. Rommel Hildreth

SAINT LOUIS OPHTHALMIC SOCIETY

November 25, 1938

Dr. Roy E. Mason, *president*

Prescribing buffered solutions

Dr. Carl Beisbarth said there are many factors which influence the effect of ophthalmic solutions used therapeutically. The proper preparation of collyria should include a consideration of two of these factors. One group of workers interested in the field of ocular therapeutics lays stress on the value of the tonicity of the solution. A solution which is nearly isotonic with the lacrimal secretion is less likely to be irritating than one which is hypertonic or hypotonic. Another group advocates the adjustment of the acid and alkaline values or hydrogen-ion concentration of the solution.

In order to maintain collyria at the desired degree of acidity or alkalinity it is necessary that these solutions be "buffered." To "buffer" is to add certain substances or solutions of those substances which maintain a definitely desired pH in a collyrium. It is, of course, necessary to select a buffer which will not interfere with the main action.

When collyria are buffered at the desired pH they are less irritating, more easily absorbed, and are more stable in action. Furthermore, a solution buffered to the proper pH may be much more efficacious than a solution of the same drug made up of distilled water. It is a fact that the presence of free acid or alkali profoundly affects the bacterial flora. The reaction may favor or inhibit the growth of organisms. A solution of boric acid may cure a case of conjunctivitis or make it worse depending upon the cause of the inflammation. The sensation produced by collyria is unimportant when a patient requires but a single dose, but whether or not the sensation is disagreeable becomes very important when the dose must be repeated frequently over long periods of time; as, for example, with physostigmine.

Pure distilled water is free from salts and theoretically has a pH value of 7.0 at 22°C. Actually the reaction to ordinary distilled water is always acid because of the absorption of CO_2. In testing a number of freshly prepared solutions of drugs ordinarily prescribed he found them all to be acid, ranging from pH 4.5 to pH 5.8. They became even more acid after standing for several weeks.

Gifford has compiled a table for the preparation of solutions of pH ranging from 5.0 to 9.0 by using various amounts of two stock solutions, one of boric acid and potassium chloride, and another solution of sodium carbonate.

It has been stated that it is not practical to hand over formulas to the druggist and get solutions of the desired pH. He has found that prescribed buffered solutions using the two basic solutions of Gifford and Smith, have always been accurate within the range of testing with nitrazine papers.

In prescribing, the pH reaction of buffered solutions selected depends upon the drug employed, because some compounds are unstable in solutions of certain hydrogen-ion concentrations. The pH of prescribed buffered solutions also depends on the condition under treatment because certain ocular injuries and infections call for the use of definite acid or alkaline

solutions. Cocaine and epinephrine are not soluble in alkaline solutions, while alkaloids are best absorbed, as well as less irritating, in an alkaline solution. Gifford recommends a solution of pH 7.6 for homatropine, atropine, and pilocarpine.

The irritating qualities of physostigmine solutions can be reduced to a minimum by using the drug in a solution which has a pH of between 6.2 and 7.6. More alkaline solutions of eserine are unstable. The resulting color change of these solutions is probably an oxidation process and can be controlled by adding a reducing agent to the solution. While the resulting color change does not affect the efficiency of the physostigmine as a miotic it does disturb the patient psychologically, and frequently the conjunctiva becomes red and irritated at about the same time that the solution has turned pink. The addition of sodium formaldehyde sulfoxylate in a concentration of 1:5000 prevents the development of color in a solution of eserine.

Butyn and phenacaine are insoluble in an alkaline solution and are incompatible with chlorides. Sodium fluorescein dissolves only at pH 9.0 (approximately a 2.5-percent solution of sodium carbonate).

The pH of tears is commonly accepted to be approximately 7.4 although some authorities state the pH varies from 7.2 to 7.6. Certain European authorities have found that ocular secretion has a pH of 8.4 to 8.6. The answer to the question of the exact pH of lacrimal fluid is obstructed by the difficulty of obtaining sufficient material and by variations in normal individuals. In general, conditions causing acidity in the eye should be treated with alkaline collyria and vice versa. If the reaction of the tears is already highly alkaline and an acid buffer solution is instilled, relief is experienced instantaneously. Corneal injuries almost without exception produce a shift to the alkaline side (pH 8 to pH 8.4) and should be compensated for by treatment with acid collyria. Ulcers of the cornea, if acute and painful, also produce a shift to the alkaline side, and an acid buffer solution affords considerable relief.

In the treatment of conjunctivitis and corneal lesions we should aim to produce the optimum pH for the growth of epithelium and connective tissue. Fisher has shown that the optimum pH for the growth of fibroblasts is from 7.4 to 7.8 and that a slight change above or below these limits materially retards growth. Fibroblasts grow only from 4 to 6 generations at a pH of 5.5 and not much over 10 generations at a pH of 8.5.

Discussion. Dr. Roy Mason said he had been interested in the science of buffering prescriptions ever since Dr. Gifford wrote his interesting paper on the buffering of ophthalmic solutions. He had found that it is possible to prescribe zinc-sulphate solutions with a buffer solution which causes very little irritation to the patient, making a more elegant prescription and just as efficient. Buffered prescriptions remain clear a greater length of time, are less irritable to the patient, and more efficient in results.

Dr. Carl Beisbarth said in reply to Dr. Elz that he did not mention silver nitrate because it is so strongly acid that it cannot be buffered. When drugs are used for long periods it is especially desirable to buffer them. A consideration of the hydrogen-ion concentration of prescribed solutions affords a refinement in ophthalmic therapeusis and may affect the results obtained in specific medication.

Filamentous keratitis with report of a case

Dr. William H. Meinberg read a paper on this subject which will be published in this Journal.

Discussion. Dr. Lawrence Post stated that there was no great difficulty in differentiating this condition from other keratitides. Characteristically, from 1 to 15 white threads of epithelium hang down from the cornea and lie coiled or floating in the tears. They are usually more numerous on the nasal side of the cornea, possibly because further from the source of the tears. That two cases should occur in the practice of one man in such a short period makes it seem that these cases are more numerous than is supposed and that they are being overlooked. If the first had not been seen, the second would have been overlooked. Dr. Meinberg had been ready to block the tear ducts, but the patient was getting better on ovarian extract, vitamins, and holocaine ointment so nothing else was done. It is probably true that ordinary methods of blocking the tear ducts are not successful and that cauterization is necessary. He has seen one case following cataract extraction. Each eye was affected but recovered without any special treatment in four or five weeks' time.

Dr. W. Luedde had had a patient, a medical student, who had a superficial keratitis related to being out in the open. He had a history of having fallen into a pan of hot water as a baby and wondered if damage had been done to the epithelium although scars had vanished. Relief was obtained by putting on rubber rimmed spectacles, rubber running along the temple. This is a way to try to get temporary relief, preventing evaporation from the cornea.

Dr. L. C. Drews had seen a man from Arizona with filamentous keratitis; there were 20 to 30 filaments on each eye. He used fibrolysine on the eyes and it cleared up. Two years later the patient returned after treatment for six weeks, and Dr. Drews again used fibrolysine with success.

Dr. William M. James said that it is interesting that considering the scarcity of tears as reported here, blocking the canaliculi should have a curative effect. The normal tear flow is taken care of largely by evaporation rather than by passage into the puncta. There are two points that might be considered in therapy. It has been reported that in experimental animals on a vitamin-deficiency diet the instillation of tears into the conjunctival sac once or twice daily will prevent corneal complications. The use of acetylcholine might stimulate an adequate flow of tears.

Lateral iridencleisis preliminary to intracapsular extraction in glaucoma associated with cataract

Dr. John Green and Dr. J. B. Workman (by invitation) reported that N. R., a woman, aged 78 years, entered the Saint Louis City Hospital eye clinic on June 15, 1938. She complained of failing vision in both eyes for the past two years. An accident 10 years prior to her entrance was followed by an ulcer on the left cornea which resulted in a scar over the pupil; consequently the vision in the left eye was somewhat impaired. A diagnosis of chronic simple glaucoma was made on the basis of a constant range of tension from 25 to 35 mm. (Schiötz) in each eye. The patient's coöperation was poor, and Dr. Workman was unable to get a satisfactory field. Both lenses showed cataractous changes, more marked in the left eye. The disc of the right eye showed a typical glaucomatous cup; that of the left eye could not be seen on account of the lens changes. Vision R.E. 6/200; L.E. 3/200, not improved by lenses.

It has always been a question how best to manage a chronic glaucoma associated with lens changes. The glaucoma itself will frequently yield to scleral corneal

trephining or some other type of filtering operation. Considerable embarrassment, however, ensues when one attempts to extract the lens in an eye in which there is a bleb from a trephine operation. In view of the fact that so many of these chronic glaucomas occur in senile eyes which all too frequently develop cataract following a successful filtration operation, it seems desirable to place the point of filtration at some point other than that involved in the section for the extraction of the cataract.

For a number of years Dr. Green has preferred iridencleisis to trephining. In his experience adequate filtration is afforded without excessive hypotony and without the formation of a large bleb. In this patient, he performed a lateral iridencleisis at the 8:30 o'clock position on the right eye and at the 5:30 o'clock position on the left eye.

The operations and recoveries were without incident. Subsequent tensions ranged from 15 to 18 mm. (Schiötz). About six weeks later the patient was readmitted to the hospital, and an intracapsular operation was successfully performed on the right eye. There were no complications. A peripheral iridectomy was made, but because the lens caught as it was being expressed, the iridectomy was converted into a complete one. There has been no interference with filtration.

Discussion. Dr. Meyer Wiener said he favors the trephining operation and thinks it is the operation of choice in glaucoma simplex. There are very few late infections. He has been performing it ever since Elliot came to Saint Louis and introduced the trephining operation. He has had most satisfactory results with cataract developing after trephining operation for glaucoma. Instead of disturbing the trephine opening he makes a corneal incision in front of the bleb and it must involve at least half the cornea or more. The incision starts at the limbus below the horizontal plane and comes out in the cornea in advance of the trephining. In at least 95 percent of cases one can extract the lens by the Smith method of tumbling. The zonule is more easily ruptured than in ordinary cataract. The same holds true for very old people. The whole secret is in making the incision large enough; making it corneal, it heals without trouble and does not interfere with drainage.

Dr. Lawrence Post said he had had a similar case last spring. The patient was an elderly lady who had high intraocular tension, with steamy corneas and bilateral mature cataracts. He trephined each eye in the upper nasal quadrant. A month or two later he extracted the cataract in one eye, making the incision away from the trephining in the upper temporal quadrant and enlarging it with scissors so that the trephine bleb remained as it was. The patient has 20/30 vision now, with a badly contracted field. The eye filters perfectly still, tension is normal in this eye as also in the other eye from which he has not yet extracted the cataract. The best procedure depends much on how hard the eye is and how long the glaucoma has persisted. In early cases with only moderate elevation of tension he believes that it is wise to extract the cataract and then observe the outcome, as sometimes the extraction of the cataract will cure the glaucoma.

Dr. B. Y. Alvis said he attended an instruction course at the Academy at which Dr. O'Brien discussed cataract technique, and this question was presented. He has had tremendous experience at Iowa State. He stated that he makes the incision through the corneal scar, making the extraction and inserting sutures as if no trephining had been done. His experience is that they do not have recurrence of tension and the bleb is not closed by the

new scar. Dr. Alvis modified Dr. Wiener's incision a little in one or two cases in which he wanted to use sutures, and thought the modification helpful. A preformed flap was made well to each side of the trephine opening. Incision followed the limbus to the top of the flaps and then came out through clear cornea just below the trephine opening. Sutures closed the wound satisfactorily. He is not sure flaps are necessary but it makes a nice device for positive closure. The lens is easily extracted as Dr. Wiener suggested, simply by expression or by using the capsule forceps. It is important that the incision be large enough.

Dr. John Green said the filtering pad after sclerocorneal trephining is all too often large, prominent, and unsightly. For best protection by the lid, the trephine hole is placed at the 12 o'clock position. After iridencleisis the filtration area is smaller, less prominent. There is no sound reason for placing it at the same site. Placing the incision for iridencleisis anywhere in the lower circle from the 3- to the 9 o'clock position insures filtration at a point that does not interfere with the cataract section if cataract is present or develops subsequently.

The best method of extracting a cataract in a very soft eye with a large filtering pad following trephining has always been a problem. Elliot is opposed to a corneal section and suggests that the incision carry through the filtering pad and terminate in a conjunctival bridge either to the temporal or the nasal side of the trephine opening. By making the section in this manner he hopes that filtration will not be interfered with.

Fascial sling for paralytic ectropion

Dr. John Green said that H. P., a 70-year-old man, came to the clinic on May 7, 1938. His complaint was that he had not been able to move the right side of his face for four-and-a-half months. The rigidity was accompanied by lacrimation, redness, and blurred vision. His ocular condition followed the extraction of a right lower premolar. The second day after this extraction he first noticed that he could not move the right side of his face, could not close his right eye, and that his mouth was drawn to the left side. The lower lid was motionless and fell away from the globe. The patient was unable to close the lids.

He was admitted to the hospital on August 28, 1938. His general condition was good and all laboratory examinations were negative. A sling of fascia lata was prepared. A groove was made with a Reverdin needle, running parallel to the lower lid and about 5 mm. from the ciliary margin, and the sling was drawn through the groove. The fascial sling extended from the internal canthal ligament to the periosteum underlying the outer third of the eyebrow, and was sutured to these tissues. Recovery was uneventful: the right lower lid is drawn up to the eyeball; there is no epiphora or recurrence of conjunctivitis. The vision is R.E., 20/25; L.E., 20/25 without correction.

Discussion. Dr. Lawrence Post said he had one little suggestion which is to make a slit in the skin at the midline and bring out the fascia lata or ox fascia there before threading it through the remaining half. He had used fascia lata in one case; ox fascia in two cases. There was no trouble with the latter.

Dr. H. Rommel Hildreth said there apparently were some misgivings about the use of the ox fascia in place of fascia lata. His experience with ox fascia had been so satisfactory it seemed unnecessary to add the leg operation for obtaining the fascia lata.

Dr. B. Y. Alvis stated that he had used ox fascia transplants, getting no undue reaction, with apparently good results.

Transplantation of slits of vertical recti for paralysis of external rectus

Dr. John Green said that V. C., a woman, aged 29 years, came to the clinic September 15, 1938. She complained of double vision and crossed eyes. She stated that at the age of 27 years she suddenly developed double vision with convergent strabismus. The crossing became progressively worse for about one week and resulted in the left eye turning in to a marked degree. She consulted an ophthalmologist, who gave her glasses and told her she would probably have to be operated on later.

At the onset of her illness she consulted her family physician who made a blood test and informed her that she was suffering from a "run-down condition." He gave her "hip-shots" twice a week for 18 months.

Physical examination included a neurological survey. All was essentially negative for the eye findings. Laboratory tests, which included several blood Kahn and one spinal-fluid Kahn test, were negative.

Eye findings: Vision, R.E., 20/25; L.E., 20/30. She had a left esotropia of 60 degrees for near and far. She fixated constantly with the right eye, tilting the head somewhat. A ptosis of the left upper lid, she stated, had been present all her life. There was a right internal ophthalmoplegia. The pupil of the left eye reacted to light and accommodation. The patient was unable to move either the right or left eye outward past the median line.

Operation by Dr. J. B. Workman on October 3d: The outer halves of the left superior and inferior recti tendons were transferred to the external rectus stump. The vertical recti tendons were slit for 10 mm. The lateral rectus tendon was resected 5 mm. and advanced 3 mm. over its stump, using the Wiener gold-plate technique. A binocular bandage was applied for seven days.

The patient uses the left eye for distance and near work. Vision in the right eye is 20/20; in the left 20/20. The patient has excellent motion of the left eye outward. She still has the ptosis of the left upper lid. The same operation on the fellow eye is contemplated.

Discussion. Dr. Meyer Wiener believed the operation could be simplified very much by transferring strips from the paralyzed external rectus instead of mutilating the superior and inferior recti. Our method, he said, is to expose the inferior rectus, split it, then cut it off 10 to 12 mm. distant from the attachment and sew the upper half of the superior rectus and the lower to the inferior rectus. In this way we do not mutilate the vertical recti and get the same result as when using a strip from the superior and inferior. At the Missouri Pacific Hospital he had a case of a man with complete paralysis of both external recti and with retraction of both interni. The patient had not been at work, as an engineer, for seven or eight years. Dr. Wiener operated on one eye, Dr. Vincent Jones on the other, and the man is back at work as an engineer on the railroad. He has very good rotation of both right and left eyes.

Dr. Carl Eber said that Dr. O'Connor described a muscle-transplantation operation similar to the one described this evening but the paralyzed muscle is not detached from its insertion. He performed the O'Connor operation in the following two cases: Mrs. C. A., 47 years old, was injured in a cyclone in March, 1925. After recovering consciousness, she had diplopia lasting four weeks. Her vision was normal in each eye with glasses. By tropometer test, she had with the right

eye external rotation of 10 degrees, upward and downward 30 degrees, and inward 60 degrees; external rotation with the left eye was 30 degrees, while rotations inward, downward, and upward were about the same as with the right eye. X-ray examination showed possible fracture of the skull in the right frontal region. O'Connor's transplantation operation was performed on the right eye; the lateral halves of the vertical recti were sutured to the upper and lower thirds of the externus. As a result the external rotation was increased to 40 degrees with that eye. Later on, partial tenotomy was performed on the internal rectus tendon in the hope that it might improve the outward rotation, but no further improvement was obtained.

Another patient, Mrs. M. M., in September, 1930, had external rotation of 10 degrees with the right eye. After an O'Connor transplantation operation the external rotation of the right eye improved to 30 degrees. Rotation is usually improved after this type of operation.

Intracapsular extraction with peripheral iridectomy

Dr. John Green presented the case of A. S., a woman, aged 46 years. The patient was admitted to the City Hospital October 24, 1938, with a mature cataract in the right eye, and an immature cataract in the left eye. On October 10, 1936, Dr. Harry Woodruff, Jr., operated, removing the lens and capsule after peripheral iridectomy.

The final visual result with a +11.00 D.sph. ⊂⊃ +0.75 D. cyl. ax. 15°, was 20/20. In September, 1938, Dr. Workman, not to be outdone by his predecessor, performed a similar operation on the left eye. The vision with +11.00 D.sph. ⊂⊃ +0.25 D.cyl. ax. 5°, was 20/20. The cosmetic result is all that one could desire.

Complete corneal coverage for ulcer in acute gonorrheal conjunctivitis

Dr. John Green said that A. Y., a 14-year-old girl, was admitted October 5, 1938, for a severe purulent conjunctivitis of both eyes. Six days previous to entering the hospital pus began to flow from her right eye. The amount, little at first, increased until the eye was constantly bathed in pus. The patient lived 175 miles from Saint Louis and had been treated by a local physician. Shortly after the inflammation began in the right eye, pus appeared in the left eye; and on admission was flowing copiously from both eyes.

Physical examination was essentially negative except for the eye condition. There was no vaginal discharge. The laboratory examination of urethral-vaginal secretions were negative for gonococcus. The pus from the eye contained large numbers of gonococci. Both eyes presented a typical picture of gonorrheal ophthalmia. The cornea of the right eye showed an ulcer at the lower inner quadrant, the base of which was necrotic. There was a small ulcer in the left eye. Under local and general treatment (sulfanilamide and typhoid vaccine) the eyes improved, but the right corneal ulcer progressed and appeared to be on the verge of perforation.

On October 9th, in spite of the acutely septic condition, Dr. Workman operated. The conjunctiva was circumcised and the conjunctival flap was pulled up over the cornea by means of a purse-string suture.

The patient had immediate relief from pain. On the fifth day, the suture was removed and the cornea no longer stained. A pseudo-pterygium remained at the temporal side of the ulcer. The vision was excellent at the time of discharge, October 24, 1938.

Discussion. Dr. B. Y. Alvis had per-

formed such an operation in one case in which the eye was profusely discharging from gonorrheal infection. The cornea was perforating, and he did not save the eye, but the operative procedure caused no unusual reaction and brought about a more rapid closure of the perforation.

H. Rommel Hildreth,
Editor.

CHICAGO OPHTHALMOLOGICAL SOCIETY

December 19, 1938

DR. GEORGIANA D. THEOBALD, *president*

NONMAGNETIC INTRAOCULAR FOREIGN BODY

DR. CLIFFORD SULLIVAN presented N. B., a Negro aged 38 years, who was in a hunting accident when several bird-shot entered the right side of his face, one entering the right eye. The marked hemorrhage behind the lens obscured any view of the fundus. Tactile tension was normal. There was no red reflex. Vision was limited to light perception and projection. X-ray examination with a Sweet localizer indicated the foreign body to be 17 mm. back, 10 mm, to the temporal side, and 6 mm. above the center of the cornea. Operation was performed on the fifth day, with removal of the shot at the place on the sclera where a dark area was seen. Visual acuity on the fifteenth day was 20/20. The fundus cleared slowly, showing a preretinal hemorrhage in the lower periphery. This absorbed in its entirety.

IRIDOCYCLITIS ON A TUBERCULOUS BASIS

DR. BEULAH CUSHMAN said that this woman, now 20 years of age, was first seen in April, 1932, with a complaint of decreasing vision in the right eye for two years. A diagnosis of iridocyclitis on a tuberculous basis with acquired heterochromia had been made at Michael Reese Hospital in 1931. She had been given 10 tuberculin injections. The eye remained quiet for six months.

Vision at that time was 0.4 —2 R.E., 1.5 L.E. There was an active right iridocyclitis with old and recent large mutton-fat deposits and cellular circulation in the anterior chamber. Posterior subcapsular-lens changes were present. Fundus and disc were normal. The left eye was normal. A positive tuberculin reaction was obtained and treatment was started and continued for six months, with some improvement, but many fresh and old precipitates remained.

In 1932, Schieck's work on taking blood from the vein in the arm and putting it into the anterior chamber, with at least temporary success in the treatment of chronic iridocyclitis, was published. This patient was given the first treatment in March, 1933. There was definite improvement, the precipitates all disappearing except the organized pigmented ones. The anterior-chamber puncture was repeated, and blood injected as they recurred; this was carried out five times between March 25 and June 7, 1933. After this the cellular activity in the anterior chamber disappeared, and the patient was presented before this Society in November, 1933, with vision R.E. 1.2—3, L.E. 1.5.

During the period between 1934 and 1937 she was seen regularly every four or five months. In May, 1938, she complained of right-sided early morning headache of two weeks duration, which disappeared after lunch; also some pain in the right eye. The corrected vision was R.E. 1.5., L.E. 1.5. The intraocular tension R.E. was 31 mm. Hg, with the pupil 4.0 mm. in size; L.E. 18 mm. Hg, with the pupil 3.5 mm.

A few live lymphocytes were scattered over the lower central portion of the

cornea and active cellular circulation was present in the aqueous. Pilocarpine 1 percent was ordered t.i.d. in the right eye. The Mantoux test was repeated with the purified protein derivative and the patient was positive to the second strength. Tension became normal within three days and the eye was comfortable. Bouillon-filtrate treatments were started and atropine instilled. The cellular reaction cleared within nine days and the eye has remained clear to date.

Following an automobile accident on October 15, 1938, the patient was in Cook County Hospital for four days because of suspected skull fracture, but no reaction appeared in the eye. The treatments have been continued and will be until she can take 100 mg. of the bouillon filtrate, when she will be advised to come in every six months for a Mantoux test. Should this be found positive the desensitization will be instituted again.

Scleritis on a tuberculous basis

Dr. Beulah Cushman presented a woman, aged 32 years, first seen on October 19, 1938, with an inflammatory nodular mass 15 by 20 mm. in size at the equator, temporally. The three nodules each measured 5 to 6 mm. in size, were firm, not tender, and there was intense injection of the whole eye.

The pupil was drawn up, the lower edge adherent to the anterior surface of the lens. The aqueous was dense, and diffuse posterior corneal precipitates were so numerous that the iris detail could not be seen. A dull-red fundus reflex was obtained in the upper quadrant. Vision was R.E. light perception; L.E. 1.5.

The Mantoux test was positive with second strength P.P.D., with an area of reaction 5.5 by 10.5 cm., and a central area of marked edema but no bleb formation 2.5 by 3.0 cm. The general physical examination was negative.

Treatment with Deny's tuberculin bouillon filtrate was instituted, and the mass became smaller; two months later it was about one fifth of the size it was when treatment was started. Vision remains the same. The anterior chamber is clear except for posterior precipitates in the central area. The iris is clearly visible, with no masses; the posterior adhesion remains the same.

Ophthalmic photography

Dr. Roy O. Riser read a paper on this subject.

Keratoplasty—an alternative method (preliminary report)

Dr. W. F. Moncrieff read a paper on this subject which will be published in this Journal.

The cross cylinder

Dr. Philip A. Halper read a paper on this subject.

Discussion. Dr. James E. Lebensohn said that Dr. Halper had given an excellent presentation of the mechanism of the cross cylinder, and showed that the test for power modified the interval of Sturm, making it shorter in one position than in the other if the strength of cylinder required change. The test for axis, however, was based on the optical transformation involved in crossing cylinders at oblique axes, and recalled the principles concerned in cylinder retinoscopy. Considering the cross cylinder as a spherocylinder with its cylinder the same sign as that in the trial frame, the essential effect of the shift would be to leave the sphere practically unmodified but to present an almost simultaneous choice of cylinder-axis shifted to one side or the other. Javal had his patient gaze at the letters while inclining the head alternately to the right and left shoulder; the eye moved instead of the cylinder. If the patient saw better with the head inclined to the right shoulder the indication

would be to move the cylinder to the right.

Southall and others showed that some error is inherent in retinoscopy; for accuracy, a subjective test is essential. Where accommodation is not active, as in cycloplegia or late presbyopia, the cross cylinder is dependable both for power and axis, but where the accommodation is active the astigmatic dial is more reliable for power, although the cross cylinder is still a valuable check for axis. For intelligent coöperation, the cross cylinder may be introduced as a "distorting glass" and the patient asked in which position the letters are less distorted. Usually only two strengths of cross cylinder are required, 0.25 for general use and 0.50 for aphakia, patients with subnormal visual capacity, or poor discrimination.

Dr. Vernon Leech remarked that he and Dr. Fowler had used cross cylinders for a good many years and found them helpful. However, the tests are subjective and consequently are liable to error. Some confusion to the patient is caused frequently by an element of brightness when the cross cylinder is used, presumably due to the effect of the minus cylinder in giving more contrast between black and white. If the patient were merely asked which position he liked better, he might give a wrong impression. More accuracy could be obtained by having him read the smallest letters that he can see on the chart, and compare the number he reads with the cylinders in the first position with the number he sees with the cylinders in reversed position.

The cross cylinder is valuable in determining the astigmatic axis. A slight turn of one-quarter diopter cross cylinders in either direction past the astigmatic axis of the eye would usually cause a more definite blurring than when regular cylinders up to 0.75 diopters were used.

Dr. Gail R. Soper pointed out that the cross-cylinder lens is usually mounted in a metal rim with a heavy handle, thus it might break easily if dropped to the floor. This could be prevented by remounting the lens in a shelltex rim with a piece of temple bar for the handle, or bakelite might be used.

Dr. Philip Halper (in closing) stated that he did not wish to leave the impression that all that was necessary is to have the patient sit in front of a trial frame, flip the cross cylinder, and thus conclude the refraction. The instrument picks up small unrecognized astigmatic errors and points the direction for the accurate axis of the cylinder. The correcting lens is then placed in the trial frame and the patient will verify the astigmatic finding by accepting the axis that was uncovered by the cross cylinder. The abstract of Jackson's paper on "The theory and use of cross cylinders," in the November issue of the Archives of Ophthalmology, is interesting. According to him "it furnishes the best method of detecting and measuring astigmatism." Crisp states that "after 40 years use Jackson regards it as the most important single means we have for measuring the refraction of the eyes."

Robert von der Heydt.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

December 20, 1938

Dr. Edwin B. Goodall, *presiding*

The history of anesthesia in ophthalmology

Dr. Harry K. Messenger read an interesting paper on the above subject.

Inclusion conjunctivitis

Dr. S. H. McKee of Montreal said that inclusion conjunctivitis appears in

one of two well-defined forms, blennorrhea in the newborn and follicular conjunctivitis in the adult (swimming-pool conjunctivitis). No sooner had Halberstaedter and Prowazek reported their findings of inclusions in the epithelial cells in cases of trachoma, than evidence casting doubt on the specificity of these bodies for trachoma appeared. In an infant with blennorrhea Stargardt found what he took to be the same inclusion bodies that had been reported in trachoma. This report was followed by numbers of others establishing a special infectious disease, "Chlamydozoa blennorrhea." Inclusion conjunctivitis, then, is a form of conjunctivitis in the newborn infant in which the severity of the infection seems to vary considerably, and in which inclusions are found in great profusion in the conjunctival cells.

In the last 55 consecutive cases of ophthalmia neonatorum seen by Dr. McKee in the Montreal area, no less than 36 were found with inclusions; in 21 cases inclusions were found alone; and in 15 others a mixed infection was present, and of this last group, 13 were due to the gonococcus.

Inclusion conjunctivitis in the adult appears in a papillary or follicular type. Involvement of the preauricular gland is quite common in both these types. Manz, in 1877, first noted in the schools of Baden an epidemic of follicular conjunctivitis which differed from trachoma in its relatively short course, absence of complication or sequelae, and its termination in complete resolution. Because of the constancy with which inclusion bodies, both intracellular and free, are found in this form of conjunctivitis, their presence and significance has aroused great interest for many years.

The inclusion bodies are composed of a matrix, in which are found initial bodies and elementary bodies. Earlier workers regarded the inclusion bodies as protozoa and pictured them as varying stages of an elaborate life-cycle. Later they were believed to represent cellular degeneration products, and other processes consequent on the attack of the virus.

The virus etiology of inclusion blennorrhea seems to have been established inasmuch as the inclusion bodies of this inflammation are similar to those found in psittacosis, and are of the same nature as those found in vaccinia variola and other recognized virus diseases. It arises by way of the genital tract of the mother, in whom the infection is, strictly speaking, venereal in origin.

Probably it is the diversity of the views regarding the make-up of the inclusion body that makes its study so attractive. Whatever their nature, there is no gainsaying the fact that they are constantly present in inclusion conjunctivitis. Of great importance, too, is their presence both in animals and humans who have been infected with filtrated material. "Whatever the structure of inclusion bodies may be, their presence in tissue is a sure sign of infection." In an inflammatory exudate, regardless of the nature of the irritant, the polymorphonuclear neutrophiles are the first cells to arrive, and the most active phagocytes of the body. Yet, in spite of this fact, in inclusion disease of the conjunctiva, at any rate, it is the epithelial cells which become the active phagocytes. Questions still unanswered are: What special condition is present to produce this effect? Is the make-up of the inclusions of inclusion conjunctivitis and the identity of the virus a problem in virus disease, or in intracellular reaction or degeneration? Will further enlightenment about the "lag stage" of bacteria solve the problem?

Trygve Gundersen,
Secretary.

COLORADO OPHTHALMOLOGICAL SOCIETY

December 10, 1938

Dr. Melville Black, *presiding*

Glaucoma errors

Dr. Harry Gradle, of Chicago, presented Elschnig's classification of glaucoma as a practical one on which to base therapy. Acute uncompensated glaucoma is best treated by an iridectomy if the case is seen within the first 48 hours. If surgery is delayed longer than that, peripheral anterior synechiae will have formed, and some type of filtering operation will be necessary. Surgery on acute uncompensated glaucoma should be performed under general anesthesia. An iridectomy should be made under a conjunctival flap. The iris is grasped with forceps and cut with small snips of the scissors so that the root excision is ragged. A peripheral iridectomy is just as satisfactory as a complete iridectomy. From 25 to 45 degrees of angle should be freed. A mydriatic should be used postoperatively only if the anterior chamber fills with blood.

In any glaucoma operation a strong miotic must be used in the eye that is not operated on lest the excitement and bandaging provoke a glaucomatous attack in that eye. The likelihood of eventual increased tension in the fellow eye is sufficiently strong that a preventive iridectomy on the normal eye is to be advised in patients with acute glaucoma. If this is not done a miotic should be used when the patient retires or if he is under an emotional strain.

Compensated glaucoma may be treated either medically or surgically, depending upon the case. The tension curve is very important in establishing a diagnosis and in directing treatment. Tension should be taken every three hours from 7 a.m. to 10 p.m. This is best done by a nurse specially trained in the procedure. At times it is of value to have the nurse follow the patient around during the day to notice the effect of daily activities upon the tension. A strong miotic should not be used too frequently as it leads to the production of lens and vitreous opacities. Glaucoma is surgical if eserine or 2-percent pilocarpine is necessary to control the tension. The home use of adrenalin to control tension is unsafe. Pilocarpine solutions easily become contaminated and may then produce a conjunctivitis. It is well to instruct the patient to boil the solution every 10 days.

Cyclodialysis may be used in that type of compensated glaucoma that is just beyond the control of miotics. It is successful in about 80 percent of these cases. It is unsuccessful in more advanced compensated and in all uncompensated cases. In performing a cyclodialysis, the ciliary body should be separated from the sclera in about one third of its extent. If this is done properly, there is always a hemorrhage into the anterior chamber. If the cyclodialysis is done inferiorly, fibrin and blood will obstruct the drainage. For this reason, it is best to do the operation in the upper and outer quadrant and keep the head elevated for 24 hours. Homatropine is to be used until the blood is absorbed, but atropine is dangerous.

John C. Long,
Secretary.

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Author's proofs should be corrected and returned within forty-eight hours to the *Manuscript Editor.* Twenty-five reprints of each article will be supplied to the author without charge. Additional reprints may be obtained from the printer, the George Banta Publishing Company, 450-458 Ahnaip Street, Menasha, Wisconsin, if ordered at the time proofs are returned. But reprints to contain colored plates must be ordered when the article is accepted.

WEVE ON RETINAL DETACHMENT

Gonin's epochal advocacy and practice of an operative treatment for retinal detachment, successful beyond all procedures previously attempted, has been followed by a succession of brilliant experimentation and technical improvements. Gonin, whose preliminary studies were published in 1919 and 1920, was tolerant, but not altogether enthusiastic, as to the claims made regarding other procedures such as diathermy and electrolysis. To the time of his death he continued to treat his cases chiefly by cautery puncture. Today, flat diathermy and penetrating diathermy lead the field.

It is natural that the surgical treatment of this ocular calamity should have been undertaken extensively in most ophthalmic clinics and by a number of well-trained and eager surgeons, in every civilized country. Furthermore, in spite of failures, the spectacular atmosphere surrounding the attempt to cure a condition previously considered hopeless has excited the lively interest of every intern and surgical assistant in institutions where relatively significant numbers of cases were available.

Surgical ambition and enthusiasm have induced many of those who witnessed such operations to feel that they were qualified and entitled to undertake the same procedures in communities in which they were practicing or in which they subsequently began to practice. Unfortunately, the results of such disciple-

ship have not always been creditable to the surgery of retinal detachment.

There is perhaps no other field of activity to which the phrase "a specialty within a specialty" can be more suitably applied than the treatment of retinal detachment. Hardly any other malady calls for such detailed and time-consuming study before surgery is undertaken, or such meticulously patient and thorough technique in the performance of the necessary operation. It would be foolish to maintain that the capacity either for prolonged and tireless study of the case, or for intricate precision in technique, is possessed in equal measure by every ophthalmic surgeon, even though his training may have been of the best. Thus it becomes doubtful whether more than a few should undertake the surgery of this condition, especially when we consider that the number of cases is too small to provide many surgeons with adequate experience.

(From the merely mercenary point of view it may be recognized that large fees are only exceptionally available, and that the financial rewards are relatively insignificant. The time and effort consumed are such as to justify the saying attributed to a prominent operator, to the effect that if one succeeds in being recognized as a retinal-detachment surgeon he will have to give up the rest of his practice.)

For every ophthalmologist, statements concerning retinal detachment by a clinician who has himself originated important surgical procedures, who can report operations upon over one thousand patients, and who claims to cure ninety percent of recent cases and eighty percent of unselected cases, must be regarded as eminently worthy of attention.

Weve, of Utrecht, Holland, who mentions that retinal detachment was formerly responsible for thirteen percent of all blindness in Holland, makes such claims (Klinische Monatsblätter für Augenheilkunde, 1939, volume 102, page 609). But he urges that no one should undertake operation for this condition, especially upon an only eye, unless he is thoroughly qualified for the responsibility, and commands adequate and expert assistance.

Every ophthalmic surgeon may theoretically possess the legal right to perform the operation for retinal detachment, and every surgeon must determine for himself whether he is morally justified in such an enterprise. But it may be judicious not to wait for the patients to decide this question.

The results tabulated by Weve show the highest percentage of successes to have occurred in three types of case, those with tears at the ora, and those in which the larger part of the detachment was "above or below the horizontal, respectively." These groups also include almost four fifths of the total number of patients operated upon. In Weve's hands the cases with tears at the ora yielded one hundred percent of successful results, the cases with the largest part of the detachment above the horizontal eighty-seven percent, and those with the largest part of the detachment below the horizontal seventy-four percent of successes.

Uniformly good results were also obtained (during the years 1935, 1936, 1937, and 1938) with the much rarer cases of hole in the fovea. For these last, Weve was at first disposed to think that Lindner's undermining method was superior to to the use of diathermy. But uniform success in the last five years causes him to declare that the diathermic technique is just as satisfactory as the more difficult undermining method.

Diagnostically, Weve insists on the necessity for powerful illumination and exhaustive ophthalmoscopic examination through the widely dilated pupil, with detailed attention to the retinal periphery.

Every ophthalmologist, says Weve,

should learn to draw the eyeground; not necessarily with artistic skill, but in such a way as to show all important details. Weve attributes much of the success with which retinal detachment has been handled in his clinic to the fact that no operation has been performed unless every essential detail of the fundus had previously been shown in a drawing. It is necessary to indicate the whole vascular system, together with the most important retinal folds and differences of level, as well as pigment masses and atrophic spots. The attached retina and vessels are shown in red, the detached retina and obliterated vessels blue, choroidal scars yellow, pigment black, and vitreous opacities and bands green. Weve urges that there is no better way to discover tears than through this habit of accurately drawing and mapping the fundus.

Weve's surgical objective is that of Gonin, "closure of the tear by direct attack." "Walling-off" is resorted to only in the rare cases where no tear can be found. The grounds for avoiding this procedure, if possible, are the incidental loss of functional retina, very intensive coagulation with the formation of star-shaped retinal folds, the danger of producing new tears, and diminished possibility of healing. Walling-off by diathermy is described as being not infrequently an "affirmation of poverty" (testimonium paupertatis)—in other words the operator admits thereby that he has not at his disposal the proper instrumentarium or the patience necessary to find and localize the tear.

Further details of Weve's technique include control by indirect ophthalmoscopy during the operation and also during convalescence, combined application of surface and perforating coagulation, and carefully calculated suction or expression of fluid with a view to bringing the region of the tear into contact with the ocular wall during the operation. A surgeon should not intentionally contemplate operating in several stages, since an eyeball previously operated upon often reacts differently and less favorably to further interventions.

Weve opens his essay with description and illustration of some interesting technical devices, among which are an arm sling to facilitate prolonged examination by the indirect method, a wire "tunnel" to enable the patient to breathe comfortably during operation, an intensive lamp for diagnostic examination of the fundus and for localizing during the operation, and a head band with protective covering for the operator's second eye while drawing the fundus.

W. H. Crisp.

THE ACADEMY MEETINGS IN CHICAGO

The American Academy of Ophthalmology and Otolaryngology convened at the Palmer House, in Chicago, on Sunday, October 8th, for its forty-fourth annual meeting. This hotel lends itself better than any in the country to the activities of the Academy. There is really only one other entirely suitable and that is the Waldorf in New York, and for this reason these two cities are particularly desirable for Academy meetings. However, there is serious objection to having the meetings in only two cities. Better to put up with inconveniences of housing in two adjoining hotels and visit different cities even though attendance may be smaller and the facilities not quite so perfect. As it happens, because of the uncertainty of the international situation and the strong desire of several cities to entertain the Academy at an early meeting, the location for the next meeting was not decided upon in Chicago, but will be announced in an early issue of the Bulletin.

One of the interesting features of the

meeting was the formation of an Academy honor society, to be made up of past presidents and a few others whom it is desired especially to recognize. Dr. Joseph Beck was elected first president. This honor society will act as an occasional advisory body for the Academy, its purpose being to utilize the experience of past presidents as well as to maintain their interest in the Academy.

A unique event was the dinner in honor of the founding of the American Board of Ophthalmology 25 years ago. Appropriate addresses were made by Dr. Lancaster and Dr. Ellett, and a handsome plaque was presented to Dr. Edward Jackson.

On Monday morning three extremely interesting papers were read at the joint session on hypertension. On Tuesday evening a dinner meeting of the Teachers' Section was devoted to a consideration of extension courses. It was recommended that these be undertaken, and a committee was appointed for this purpose. Later this recommendation was accepted by the Council, so that probably within the year these courses will be introduced. Quite obviously this is not the ideal method of instruction, but it is a beginning, and certainly at a time when it is not yet possible to provide residencies with basic training for all those desiring them. Instructional correspondence courses will help as a stop gap. They will also serve older men who wish instruction and have not the time to attend long basic courses, yet are not satisfied with merely the condensed lectures obtainable in short courses.

The regular sections and the motion-picture section offered some excellent material. The scientific and the commercial exhibits were very good. It was decided to continue the scientific exhibits annually or as often as desired, and a program committee was appointed to provide for the continuance of this feature. Every year these exhibits improve; the newer refinements of colored photography are an important reason for this.

Entertainments were of a high order and strictly pertaining to the Academy.

To say anything of the Section on Instruction is unnecessary, as it is always a high light of the Academy meeting.

Dr. Frank Spencer was chosen president-elect and Dr. Arthur W. Proetz first vice-president. Probably no one in this country has made the original contributions to otolaryngology that Dr. Proetz has made, and this is a well-deserved honor. Dr. Spencer's election seems equally appropriate, and under Dr. Frank Brawley's and their leadership, the next meeting of the Academy should be a very successful one.

LAWRENCE T. POST.

BOOK NOTICES

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY. Forty-third Annual Meeting, 1938. Clothbound, 447 pages, illustrated. Omaha, 1939.

The Transactions of the forty-third annual meeting of the American Academy of Ophthalmology and Otolaryngology was dedicated to Dr. John Finch Barnhill, president of the American Academy of Ophthalmology and Otolaryngology in 1932, a distinguished teacher of ophthalmology for many years. The address by the president, Dr. Harry S. Gradle, was characteristic of the author in its forward-looking program containing the suggestion of a plan for home instruction. This idea was accepted by the Academy and the plan should soon be functioning.

The first half of the Transactions is devoted to otolaryngology, the latter half to ophthalmology.

The opening paper of the ophthalmic section is on the operative treatment of

radiation cataract. Reese concludes that this type of cataract, which tends to show a proliferation of the epithelium under the anterior capsule into a metaplastic fibrous layer, should be operated on by the intracapsular method of extraction. The capsule is strong and capable of withstanding the necessary traction. On the other hand, extracapsular extraction is contraindicated because of the lens epithelium which may continue to proliferate to form dense fibrous tissue.

Bernard Samuels has given a complete and beautifully illustrated discussion on ossification of the choroid. He concludes that there is practically no danger of sympathetic ophthalmia from eyes so ossified. Ossification or bone formation can scarcely occur in sympathetic ophthalmia because of the destruction of uveal tissue. He further stated that there was no special liability of sarcoma developing in shrunken, ossified globes. Numerous other important facts were brought out. A detailed study of the paper is well worth while.

Ocular papillomata were discussed by R. E. Windham. The description of the successful treatment with the thermophore was a feature of the paper.

Since the introduction of homatropine-benzedrine cycloplegia, its use has rapidly become popular. Lyle S. Powell reported on it further and concludes that it is a valuable method that might be substituted for the usual homatropine routine. It appears to be equally efficacious and has the great advantage of being transitory, so that accommodation is recovered by the following day, even in adults.

An unusual subject was that discussed by Moacyr E. Alvaro of São Paulo, who described the deleterious effect of snake venom on the eyes, and its use in ophthalmology. At present the latter seems rather in the experimental stage, but possibly the future may prove it of value.

James W. White and Harold W. Brown pointed out the frequency and importance of vertical anomalies in muscular imbalances. A thorough study should be made of these before attempting the correction of lateral deviations and in many cases it is advisable to operate on the vertical muscles before operating on the lateral.

A new method for the transplantation or implantation of the lacrimal sac in chronic dacryocystitis was presented by William H. Stokes. The major advantage was its simplicity of performance; although involving the nose, very little nasal manipulation was necessary. It was thought that ophthalmologists not specially familiar with nasal procedures could safely perform this operation.

V. Reeves Hurst considered oculoglandular diseases with special reference to tularemia and Parinaud's conjunctivitis. He reported 23 cases. No difference could be observed between those in which the leptothrix was found and those in which it was not found. Two cases of oculoglandular tularemia were easily distinguishable from cases of Parinaud's conjunctivitis by the clinical course and agglutination tests.

Lawrence T. Post.

L'OEIL ET LES MALADIES PROFESSIONNELLES (MALADIES DU TRAVAIL). By Ch. Coutela. 612 pages with 43 illustrations. Paris, Masson et Cie, 1939.

This book is encyclopedic in its scope. It covers the field in painstaking detail, every conceivable toxic agent being given ample consideration. After the presentation of a general historical background and a definition of occupational diseases, the subject matter is divided into five main sections. The first deals with vapors, gases, and powders. The second considers radiant energy: heat, light, radium emanations, and X rays. In the third part are

considered the various intoxications, such as by lead, hydrocarbons, and alcohol. The fourth part takes up infectious and parasitic agents. The roles played by fatigue and changes in the atmospheric condition are considered in the fifth part. Each section has its own particular historical introduction and a bibliography. Finally there is a chapter on medico-legal aspects of occupational diseases.

This volume will be of assistance to all ophthalmologists who can read French, whether their practices are industrial or not. In this connection it may be said that one need not know much French to make use of the material in this book. The descriptions are so logical and well outlined that even a beginner could follow most of them quite satisfactorily. The only criticism that one might make is the paucity of illustrations. However, completely illustrating this work would fill at least another volume and make the cost prohibitive.

Frederick A. Wies.

CORRESPONDENCE

European Clinics

Dr. Alston Callahan sends us the following description of a recent pilgrimage to various European eye clinics:

July 29, 1939.

In London the surgical technique of Ida Mann was noteworthy for its speed with no sacrifice of meticulousness; for example, she does an Elliot trephining in about five minutes. Miss Mann has a clinic for contact-glass fitting, and told me that the English government was buying them in large numbers for those soldiers injured in the World War by mustard-gas burns of the cornea. The companies that make them have about 600 models and select the one closest to the proper fitting and modify it as is necessary. As soon as they are successfully fitted, the government stops their pension. Mr. Neame showed me, among other cases, a three-year-old girl with an enormous chalazion, which had recurred despite proper surgery. After some investigation, it was found that she had a strongly positive Wassermann, and prompt antiluetic treatment, just instituted, was curing the disease. Mr. Neame's surgery was instructive to watch, as was also that of one of the younger men, R. W. Rycroft. Rycroft has done a number of corneal grafts, and uses a large trephine to cut a complete section of the cornea. One of his very interesting cases was that of an infant with bilateral glioma; one eye had already been removed, and he was attempting to stop the neoplasm with diathermy, instead of radon seeds, which he had used previously.

In Paris the Society for Development of Relations with Visiting Doctors sets a standard hard to equal. Their friendly help, the daily mimeographed bulletins of operations mailed out to the hotels, leave one very prejudiced in their favor. Prof. Elliot Terrien, at Hotel Dieu, uses Elliot trephines for most of his glaucoma cases; he removes cataracts underneath an undivided conjunctival flap, pushes from below against the lower limbus with the lower shaft of the eye speculum. Dr. Victor Lagrange does all cataracts, except those he designates as "white," by intracapsular method, and uses a forceps and a "pusher" of his own. He has his assistants instill cocaine and adrenalin into the eye every few minutes for an hour before he begins the procedure of extraction; and he believes that the collapsing of the cornea and the resting quietly of the vitreous is due to this anesthesia. He admits a slight escharotic action on the corneal epithelium, but states that in his experience this recovers in a few days. In dealing with the skin, as for example after removal of a lacrimal sac, he sutures only subconjunctivally and allows the

surface tissue to grow together without sutures holding it.

In Zürich Professor Vogt was most gracious and hospitable. His residents must stay four years, having already had, of course, the six years required to secure a degree. His first motto in teaching is "Do nothing that will harm the eye." Because a resident once caused a lenticular opacity by improper manipulation of a keratome in doing an iridectomy, all such procedures must now be done with a knife, slicing down on the limbus until the anterior chamber is reached, the iris allowed to come into the wound and divided; they may not reach down into the anterior chamber for it. I had never before seen Vogt's tongue-shaped instrument for X-raying the eye for foreign bodies; after the conjunctiva is anesthetized, it is pushed securely into the inner canthus, the X-ray tube being placed at right angles to the plate, which fits on the instrument. Professor Vogt's pathologist handles about 7,000 eyes annually, and was kind enough to show me one of the prizes of their collection—sections of an eye in which had occurred a recent retinal separation. The patient had been killed shortly after the onset of this condition, and after death the eye was secured. The hole can be easily demonstrated, and, incidentally, Professor Vogt never operates on a retinal separation unless the hole can be found. He does not teach his students the intracapsular method, since he believes only those few specially gifted should employ it.

In Basel I found Prof. Alfred Gigon a warm host. He showed me a recent edition of the Ars Medici, which, as previously mentioned in the Journal, is now published in Switzerland. He referred me to Professor Bruchner, who has an excellent eye clinic in this city.

While there were many changes in Vienna and in the clinics, Lindner's and Miller's clinics seemed to be in full operation. I had never been to Vienna before, so could not compare it with its previous status. Many classical procedures were performed while I was there.

In Budapest, the dean of ophthalmologists is Dr. Emile de Grosz, now retired. Dr. Blascovicz was appointed to succeed Dr. Grosz as professor of the Hungarian Eye Clinic, but unfortunately died last year. At the present time, official appointment has not been made, but Dr. Grosz's son has achieved much in his own right. Prof. Dr. Zoltan Toth is quite prominent in the work of the clinic; he believes fervently in a suture through the sclera to hold the corneal flap after cataract extraction. They take great pride in plastic surgery here after Blascovicz's techniques; they use horsehair and human hair for suture material. In contrast to Professor Vogt, they believe very strongly in intracapsular removal of cataracts and it is very remarkable to witness how much "push" they use, how little "pull" in the procedure.

I was not a little surprised and pleased to see in how many of these foreign clinics, the American Journal of Ophthalmology is read and appreciated. Professor Gigon especially seemed to appreciate your [Dr. Crisp's: ed. note] reference to him in a recent issue.

(Signed) Alston Callahan, M.D.

NOTE

Two typographical errors appeared in the editorial department of the September issue; namely, on page 1030 Sudeten should be so spelled, and on page 1033 the group before which Dr. Bielschowsky's series of lectures was given was the Mid-Winter Clinical Course of the Research Study Club of Los Angeles.

ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP
ASSISTED BY DR. GEORGE A. FILMER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is only mentioned in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis.
2. Therapeutics and operations.
3. Physiologic optics, refraction, and color vision.
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy, embryology, and comparative ophthalmology

10
RETINA AND VITREOUS

Gray, R. J. **Retinal hemorrhages after transfusion.** Amer. Jour. Ophth., 1939, v. 22, Sept., pp. 979-984.

Guist, Gustav. **Amelioration of visual function of damaged retina.** Klin. M. f. Augenh., 1939, v. 103, July, p. 77.

Under minimal nutrition, in spite of the great lability of the retinal cells, they may remain living without functioning. If this condition lasts too long the cells die. Latzel has shown that specific substances of an organ may increase its function. Guist confirmed this by intracutaneous injections of "xipoid retinale," a substance obtained from healthy retinae of young animals, and used in intraocular diseases where decrease of vision is caused by underfunction of the retinal cells. Vision was improved in flat detachment of the retina (not completely reattached by operation), senile degeneration of the macula, sclerosis of the choroid, drusen of the macular region, and occasionally in hemorrhages from hypertension, diabetes, and renal disease. Results are shown in ten detailed clinical histories. Visual improvement was maintained by repeated injections. C. Zimmermann.

Klien, B. A. **A case of so-called Oguchi's disease in the U.S.A.** Amer. Jour. Ophth., 1939, v. 22, Sept., pp. 953-955.

Nicolacopoulos, J. **An unusual ophthalmoscopic picture.** Bull. Soc. Hellénique d'Opht., 1939, v. 8, Jan.-March, p. 43.

A 16-year-old girl with greatly reduced vision showed a large macular lesion with other changes extending from the disc over the upper part of the retina. The condition was thought possibly to be due to a separated retina which had reattached.

George A. Filmer.

Saidovski, A. G. **Pigmented spots in the fundus.** Viestnik Opht., 1939, v. 14, pt. 6, p. 74.

Examination of a patient with retrobulbar neuritis revealed a dark semilunar area adjacent to the disc and

measuring 4 by 6 disc diameters. Pigmented spots in the fundus are congenital and probably caused by disturbance in intrauterine development. (Illustrations.) Ray K. Daily.

Schneider, Karl. **Embolism of the central retinal artery and its treatment.** Klin. M. f. Augenh., 1939, v. 103, July, p. 93.

A woman suddenly developed a dull feeling in the whole head and then found she could not see with the right eye. In her early youth a heart disease had been diagnosed. She presented the typical changes of embolism of the right central retinal artery with extensive circumpapillary edema. Following immediate digital massage and retrobulbar injection of atropine, vision rose to 5/15 eccentrically the next day. A large grayish-white embolus was seen in the lower half of the right inferior-nasal branch. Under continued massage, retrobulbar atropine injections, and intramuscular injections of eupaverine, on the third day some blood could be seen as a thin thread flowing past the embolus. The treatment was continued and vision returned to normal in about a month.

C. Zimmermann.

Stasinska, J. **Cysts of the retina.** Klinika Oczna, 1939, v. 17, pt. 3, p. 386.

A woman 27 years old came to the clinic with a history of sudden blindness. On examination she was found to have a retinal detachment, and close to the ora serrata in the temporo-inferior segment of the eyeball was seen a large transparent cyst 4 by 6 disc diameters in size. A diathermocoagulation was performed; during the operation the cyst ruptured and the retina became reattached. Ray K. Daily.

Tatár, Josef. **Retinitis pseudonephritica and periarteritis retina following erythema nodosum.** Klin. M. f. Augenh., 1939, v. 103, July, p. 84.

Ocular manifestations following erythema nodosum included small vesicles and papules of the conjunctiva, scleral infiltrations, and hypopyon iritis with opacities of the vitreous. Tatár describes an unusual case of periarteritis and retinitis pseudonephritica in a man of 39 years suffering from erythema nodosum. The affection consisted of exudations around the central retinal artery, preretinal and retinal hemorrhages, and formation of a star figure. The hemorrhages recurred several times simultaneously with the erythematous relapses and later uveitis set in. Tuberculotoxic allergy was demonstrated and the prognosis was unfavorable on account of diminishing vision with the frequent relapses. The case did not yield to the usual tuberculin therapy, but reacted well to rubrophen injections. C. Zimmermann.

Tooke, F. T., and Nicholls, J. V. V. **Changes in the fundus oculi following splanchnectomy for malignant hypertension.** Canadian Med. Assoc. Jour., 1939, v. 41, July, p. 21.

A series of fifteen cases of malignant hypertension in which a splanchnectomy was done is reported. From every standpoint, including that of the fundus oculi, 2 were cured, 3 markedly improved, 8 moderately improved, one unchanged, and one definitely worse. Although the effect on the blood-pressure level was in most patients disappointing, the improvement in the fundus findings and visual acuity was in several cases very marked. Thirty-seven percent of the cases had no fundus changes. T. E. Sanders.

Trantas, A. **Retinal cyst simulating a detachment.** Bull. Soc. Hellénique d'Opht., 1939, v. 8, Jan.-March, p. 49.

A 42-year-old man presented a smooth elevation of the retina in one quadrant between the equator and the ora serrata. The retina and subretinal fluid were transparent, and choroidal vessels could be seen with the diaphanoscope. Vision was good and the condition had remained stationary for eight months. George A. Filmer.

Volokitenko, A. E. **Osmotherapy in myopic chorioretinitis.** Viestnik Opht., 1939, v. 14, pt. 6, p. 22. (See Section 7, Uveal tract, sympathetic disease, and aqueous humor.)

Walker, C. B. **Combined galvanodiathermic unit for surgical treatment of separated retina.** Trans. Sec. on Ophth., Amer. Med. Assoc., 1938, 89th mtg., p. 304.

This unit combines diathermy and galvanic current, delivered through one cord and one indifferent electrode pad, and controlled by means of a twin footswitch. Outlets for head light and ophthalmoscope are also provided. (One illustration.) George H. Stine.

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

Agnello, Francesco. **Toxic amblyopia from felix mas.** Rassegna Ital. d'Ottal., 1939, v. 8, March-April, pp. 210-221.

Following the discharge of a tapeworm, a 28-year-old soldier was given a dose of 40 to 50 grams of felix mas. Within four hours unconsciousness developed and persisted for 36 hours. Upon regaining consciousness the patient manifested complete bilateral blindness which did not respond to any treatment, including the use of acetylcholine. Ophthalmoscopically there was the faintest retinal edema, with normal-appearing nerve heads and slight contraction of the arteries. Gradually atrophy of the nerves developed. The author gives a review of our knowledge of toxic amblyopia caused by this drug. (One figure.) Eugene M. Blake.

Besrukova, M. I., and Ochapovskii, S. V. **Optic-nerve disease caused by plasmocide poisoning.** Viestnik Opht., 1939, v. 14, pt. 5, p. 60.

Plasmocide in toxic doses is a neurotropic poison, attacking the central nervous system and causing a toxic encephalitis. The optic nerves are involved early with complete loss of vision. Some restoration of vision follows but the prognosis is grave, the final visual acuity being 0.1 or less. Oculomotor and pupillary disturbances are absent. The disease is not fatal and histopathologic examinations have not been available. The author believes that large toxic doses involve the ganglion cells of the gray matter, and long-continued small doses attack the peripheral nerves. Ray K. Daily.

Dieffenbach, Pierre. **Tuberculosis in the optic nerve and disc.** Ann. d'Ocul., 1939, v. 176, July, pp. 497-517.

A 23-year-old male with a family history of tuberculosis and previous history of serofibrinous pleurisy presented himself for eye examination. In the right eye there was slight edema of the disc with some dilatation of the vessels. Vision was 0.7. In the left eye there was no light perception and the disc was congested and swollen with many vessels in the edema. There were several hemorrhages and exudates around the disc. The ocular lesions progressed slowly and in a month the patient was brought in for autopsy which disclosed

tuberculosis of the lungs, peritoneum, meninges, and frontal lobes. Histologic examination of the eyes revealed in the right eye papilledema accompanied by lymphocytic infiltration. There was similar lymphocytic infiltration in the optic-nerve sheath. The left eye showed a caseous mass in the intrascleral portion of the optic nerve. The retina was edematous and detached as far forward as the equator. The author believes that the papilledema in the right eye was a result of increased intracranial pressure, but that the lesion in the left eye was a specific tuberculous involvement. The literature is reviewed extensively.

John M. McLean.

Fischer, Franz. **The question of so-called permanent choked disc.** Klin. M. f. Augenh., 1939, v. 102, May, p. 656.

A woman of 44 years with a tumor of the hypophysis had choked discs which had shown no ophthalmoscopic or functional change in five years. The choked discs of another woman of 37 years with angioma capitis showed no change in 14 years. These cases confirm the observation of Pick that choked disc due to intracranial pressure may remain unchanged for years.

C. Zimmermann.

Herrenschwand, F. **Participation of the optic nerve in postvaccinial encephalomyelitis.** Klin. M. f. Augenh., 1939, v. 102, June, p. 815.

In 1931 (Beitr. path. Anat., v. 87, p. 161) the author published his observations on diseases of the optic nerve in encephalitis after vaccination, a complication which apparently had been previously overlooked. He now reports three cases with autopsy findings, according to which the optic-nerve involvement is interpreted as acute retrobulbar neuritis, clinically resembling that seen in myelitis, multiple sclerosis, and encephalitis lethargica. Histologically the postvaccinial type differs from the others in showing proliferation of glial cells in continuous seams around the veins. C. Zimmermann.

Kosmin, V. I. **The treatment of optic atrophy caused by plasmocide with retrobulbar injections of atropine and strychnine.** Viestnik Opht., 1939, v. 14, pt. 5, p. 34.

A tabulated report of ten cases of optic atrophy, five of which were caused by plasmocide, shows that the effect of atropine and strychnine is superior to that of atropine alone. Ray K. Daily.

Machado, N. R. **Postinfectious optic neuritis and acute iridocyclitis.** Trabalhos do Primeiro Cong. Brasileiro de Ophth., 1936, v. 2, pp. 517-521.

The author discusses briefly the pathogenesis of the optic neuritides which develop as sequelae of different exanthemata. Two cases are reported, one of acute optic neuritis following measles, the other of acute iridocyclitis following inflammation of the parotid gland. The first case, in which vision diminished considerably, recovered completely after treatment with foreign protein, saline laxatives, intravenous calcium injections, nasal disinfection, acetyl chloride, strychnine, iodides, and light baths. The second case recovered after treatment with mydriatics and hot applications. Ramon Castroviejo.

Redslob, M. E. **The teeth and the optic nerve.** Ophthalmologica, 1939, v. 97, June, p. 133.

The author reports his clinical experiences with a patient in whom he believes an attack of retrobulbar neuritis was caused by a dental infection. Both nerves were involved at intervals

of two years and each time recovery immediately followed the extraction of a tooth that had an apical granuloma. The hypothetical mechanism of the transmission of the infection is discussed and the author emphasizes two possibilities: (1) angiospasm in a retrobulbar part of the optic nerve as a result of reflex irritation caused by the affected tooth, and (2) focal infection initiating an allergic reaction in the optic nerve. F. Herbert Haessler.

Smith, E. G. **Unilateral papilledema; its significance and pathologic physiology.** Arch. of Ophth., 1939, v. 21, May, pp. 856-873.

The author reports twelve cases to illustrate unilateral papilledema from intraocular, intraorbital, intracranial, and systemic causes. The papilledema may not be homolateral and cannot be depended upon for localization. Patients presenting unilateral papilledema should be subjected to a study including measurement of intraocular pressure, exophthalmometer reading, neuro-ophthalmic examination with spinal-fluid studies, and roentgen examination of the head including the optic foramens and the sinuses. Smith discusses the relation of intraocular pressure to papilledema, particularly in arterial hypertension, and the yielding of the lamina cribrosa, with direct compression of the vein and elevation of the retinal venous pressure. (Bibliography.) J. Hewitt Judd.

Sobanski, Janusz. **A slate-gray optic disc.** Klin. M. f. Augenh., 1939, v. 102, May, p. 704.

In 1914 the right eye of a man of 51 years had been enucleated for absolute glaucoma. In 1920 the sight of the left eye suddenly failed on account of detachment of the retina which was not improved by injection of salt solution. An operation performed in 1934 was without result. There was intense horizontal, and occasionally rotatory, nystagmus. The optic disc was slightly oval with sharp borders and of slate-gray color. The blood vessels at the peripheral part of the disc were well visible, but became centrally indistinct on the dark disc. There was a slight physiologic excavation. A peripapillary flat detachment became greater toward the periphery and showed some fine hemorrhages. Repeated operations for the detachment were without effect. Only two such cases have been published. With regard to the slate-gray disc, the author adopts the opinions of Hirschberg and Foerster of an anomaly of development belonging to the group of melanoses of the optic nerve.

C. Zimmermann.

Strong, J. C., Jr. **Case of bilateral optic atrophy following insect bite.** Amer. Jour. Ophth., 1939, v. 22, Aug., pp. 906-907.

Tarlovskaja, S. I. **Prolonged choked discs of malarial etiology.** Viestnik Opht., 1939, v. 14, pt. 6, p. 68.

A woman 35 years old, with malarial serous meningitis, had bilateral choked discs with normal vision and enlarged blind spots. During a three-month period of observation there was practically no change in the appearance of the fundus, while the general symptoms fluctuated under treatment. The literature contains seven reports of choked disc with meningeal symptoms of malarial etiology; in all there was improvement and final recovery under repeated spinal punctures.

Ray K. Daily.

12

VISUAL TRACTS AND CENTERS

Dejean, C., and Ferrie, J. **Etiology of visual hallucinations.** Arch. d'Opht. etc., 1939, v. 3, June, p. 511.

Three patients convalescing from ocular operations presented all varieties of visual hallucinations: micropsic, microteleopsic, lilliputian, macropsic, monstrous, and normopsic. The hallucinations disappeared when the bandages were removed. This indicated that the functional excitation of the cerebral cortex was initiated by the suppression of vision, and not by images originating in the retina, since the latter is but a conducting organ. (Bibliography.)

Derrick Vail.

Koslowski, Bogumil. **Several cases of pituitary and presellar tumors.** Klinika Oczna, 1939, v. 17, pt. 3, p. 360.

Four cases of pituitary tumor are reported. One patient, a boy eight years old, came to the hospital with vision reduced to light perception and symptoms of raised intracranial pressure. Following two spinal punctures vision improved sufficiently to permit perimetry, and a bitemporal hemianopsia involving the fixation points was then demonstrable. X-ray therapy led to marked improvement of vision but the case ended fatally. The second case, a woman 26 years old with bitemporal hemianopsia, headache, and vomiting, also improved under X-ray therapy but died seven months after treatment was discontinued. The third case, a girl 19 years old, had choked discs, and an intracellar tumor was demonstrated by X-ray. The patient recovered under X-ray therapy. The fourth case, a man 54 years old with a bitemporal hemianopsia and complete destruction of the sella turcica, was treated by X ray and radium. A week after the third exposure to X ray he developed hypotony and retinal detachment of the left eye.

Ray K. Daily.

13

EYEBALL AND ORBIT

Allen, T. D. **Revised technique for bone implant.** Amer. Jour. Ophth., 1939, v. 22, Aug., pp. 902-903.

Blake, E. M., and Mason, D. **Chronic orbital osteomyelitis caused by typhoid bacillus.** Amer. Jour. Ophth., 1939, v. 22, Sept., pp. 1019-1021.

Krause, A. C., and Stack, A. M. **Citric and malic acids of the ocular tissues.** Arch. of Ophth., 1939, v. 22, July, pp. 66-72.

Because there is a definite need for inquiry into the organic-acid metabolism of the eye, this investigation was made into the quantities of citric and of malic acids of the ocular tissues. The method of analysis is described and the results presented in a table. The ratio of citric acid to malic acid was 1 to 10 in each ocular tissue. The metabolism of these acids in relation to the eye is discussed. J. Hewitt Judd.

Krause, A. C., and Tauber, F. W. **Creatine and creatinine of the ocular tissues.** Arch. of Ophth., 1939, v. 21, June, pp. 1027-1030.

Creatine and its anhydride, creatinine, are important substances taking part in the metabolism of tissue. It is probable that creatine metabolism may be related to cataract in dystrophia myotonica, to atrophy of the ocular muscles in myasthenia gravis, and to other ocular diseases. Because the knowledge of ocular creatine is so meager, a study of bovine ocular tissues was made. The authors describe

their procedure and report the colorimetric determination of creatinine and total apparent creatinine (creatine plus creatinine). Creatinine of lens, iris, retina, optic nerve, and cornea was isolated as the potassium pictrate.

J. Hewitt Judd.

Miklós, Andor. **Cure of a spontaneous orbital hematoma.** Klin. M. f. Augenh., 1939, v. 102, May, p. 699.

A woman of 29 years who had been for five days suffering from a dull pain in the right half of the head suddenly felt a cracking in the left orbit and a gradual protrusion of the left eyeball with chemosis, ecchymosis, and swelling of the lids. The veins of the fundus were somewhat enlarged; vision 5/10. The eye was covered with a watch crystal and the patient was given iodine. An ulcer developed in the lower part of the cornea, but the hematoma gradually absorbed and the ulcer healed after ten days in the hospital. The exophthalmos subsided, vision returning to normal. C. Zimmermann.

Mueller, Friedrich. **Questions about ocular circulation.** Trabalhos do Primeiro Cong. Brasileiro de Ophth., 1936, v. 2, pp. 524-526.

The author discusses at length the work of Havlicek on the physiology of blood circulation. According to Havlicek, the blood vessels may be classified in two groups, private vessels and public vessels. For instance, he calls private vessels those which, on entering the kidney, limit their action to supply blood to the kidney itself for its nutrition. Public vessels would be those which going to the glomeruli have a function of great importance to the rest of the organism, such as the excretion of urine. In regard to the capillary circulation, Havlicek believes that there is a network of larger vessels which directly connect the arteries with the veins without the intermedium of the capillaries. The function of these intermediate blood vessels, which Havlicek calls precapillaries, would be to shut off the capillary circulation when regulation of the supply of blood in some organ or the secretion of some gland was necessary. This theory applies to the eyes. The author concludes from the study of Havlicek that the retinal vessels would be public ones, while the choroidal vessels and the long and short posterior ciliary arteries would be private ocular blood vessels, which may play an important role in the regulation of normal intraocular pressure. The study of the precapillary circuits of the eye, which are able to regulate the intraocular pressure, may give the answer to the pathogenesis of the different types of glaucoma.

Ramon Castroviejo.

Odintzov, V. P. **Metastatic ophthalmia.** Viestnik Opht., 1939, v. 14, pt. 5, p. 3.

A review of the literature and an analysis of 464 reported cases. The author finds that clinically the disease assumes three types: (1) an acute purulent perforating panophthalmitis ending in phthisis bulbi (caused by the streptococcus, and usually seen in puerperal sepsis); (2) a subacute form, sometimes perforating but usually ending in atrophy of the globe without perforation (caused by the pneumococcus and meningococcus); and (3) an indolent form, occasionally ending in recovery, but usually leading to atrophy of the globe (seen with meningococcus infections, but most frequently as a complication of grippe, measles, or typhus). The author believes that the disease is caused not by thrombi from

the original focus, but by minute infective particles circulating in the blood and arrested in the small lumens of the retinal and choroidal capillaries.

Ray K. Daily.

Petrov, A. A. **A case of unilateral intermittent exophthalmos.** Viestnik Opht., 1939, v. 14, pt. 6, p. 76.

A woman 25 years old had an attack of exophthalmos of the left eye whenever she did any work which required leaning over. After an exhaustive examination, essentially negative, the diagnosis was exophthalmos due to dilated orbital veins caused by an endocrine disturbance of pregnancy.

Ray K. Daily.

Popova, S. A. **Bacillus proteus vulgaris.** Viestnik Opht., 1939, v. 14, pt. 6, p. 72.

A report of panophthalmitis caused by bacillus proteus vulgaris, complicating a combined cataract extraction.

Ray K. Daily.

Reber, J., and Scheie, H. G. **Bilateral endophthalmitis complicating pneumococcic septicemia.** Arch. of Ophth., 1939, v. 21, May, pp. 731-734.

The first manifestation of a generalized septicemia in a man aged 48 years was bilateral endophthalmitis occurring two weeks after a puncture wound of the foot which caused a local infection and lymphangitis of the foot and lower part of the leg. Death ensued after five weeks and at autopsy the patient was found to have multiple infarctions of the spleen and kidneys, bronchopneumonia, endocarditis, and phlebitis of the left femoral vein. Cultures from the blood and from fluid aspirated from the eye were positive for type 16 pneumococcus. J. Hewitt Judd.

Walker, C. B. **Graduated posterior evisceration.** Trans. Sec. on Ophth., Amer. Med. Assoc., 1938, 89th mtg., p. 309.

This is a modified evisceration in which a large glass or plastic ball is implanted within the scleral shell. The operation is described in detail.

George H. Stine.

14

EYELIDS AND LACRIMAL APPARATUS

Almeida, A. de. **External dacryocystorhinostomy.** Trabalhos do Primeiro Cong. Brasileiro de Ophth., 1936, v. 2, pp. 435-439.

The author prefers dacryocystorhinostomy to extirpation of the sac in the treatment of chronic dacryocystitis. He has performed 12 operations following the technique advocated by Dupuy-Dutemps, and 15 using the Toti technique. Of a total of 27 operations, the result was perfect in 14 cases, fair in 3, and without improvement in 4. Six cases could not be followed long enough to report the final result.

Ramon Castroviejo.

Arutinov, V. I. **A chancre of the lid border of the upper lid, simulating a stye.** Viestnik Opht., 1939, v. 14, pt. 6, p. 67.

A report of a case of hard chancre of the lid in a woman 22 years old.

Ray K. Daily.

Askalanova, T. M., and Zakharova, A. P. **The correction of ptosis with buried sutures.** Viestnik Opht., 1939, v. 14, pt. 6, p. 64.

Two sutures are introduced in the manner of the Snellen sutures with the knots buried in the frontalis muscle. (Illustration.) Ray K. Daily.

Bulach, X. **Blepharoplasty with a free skin transplant from the auricle.** Viestnik Opht., 1939, v. 14, pt. 6, p. 46.

The skin from the posterior surface of the auricle is particularly suitable for repair of cicatricial ectropion, because it is morphologically and biologically related to the face. Thirteen cases of cicatricial ectropion caused by anthrax were operated upon in this manner with excellent results. In two cases of tuberculous ectropion and in one case of defect of the lid caused by a carcinoma, the results were not good because in each instance the thin cutaneous transplant was inadequate to fill the deep defect. Ray K. Daily.

Diggle, F. H. **Intranasal drainage (West's operation) for the relief of lacrimal obstruction.** Practitioner, 1939, v. 142, June, p. 773.

The author discusses the technique and indications for the intranasal dacryocystorhinostomy of West. He reports a series of 99 cases, 78 of whom have been traced. Of these 74.3 percent were completely successful, 11.5 percent moderate cures, and 16.6 percent complete failures. T. E. Sanders.

Gifford, S. R. **Paradoxic elevation of the lid.** Arch. of Ophth., 1939, v. 22, Aug., pp. 252-256.

A child aged ten years presented a picture of complete paralysis of the left third nerve, with complete paralysis of elevation and depression in both eyes. After a Blaskovics operation on the left upper lid, a paradoxic movement was noticed which has not been previously described. When the right eye was opened naturally, the left upper lid drooped completely. During natural winking movements, each time the right lids were closed the left upper lid showed a spastic movement of elevation. The lid was raised 5 to 6 mm., the movement lasting less than a second, after which complete relaxation of the lid occurred immediately. The movement was evidently made by the levator muscle, since the frontalis muscle did not participate. On natural closure of the eyes, as in sleep, and on forced closure the same rapid elevation of the lid occurred, although it was sometimes slighter than the movement seen in winking. After this rapid movement executed by the levator muscle, the lid was elevated by the frontalis muscle 3 to 4 mm. and remained in this position during forced closure of the right lid. The quick movement was not under voluntary control but occurred automatically with each closure of the right lids. There was no upward movement of either eye on closure of the lids, the left eye remaining turned 15 degrees lower than the right and abducted about 50 degrees. No similar retraction occurred when the child attempted to look up or down. The left pupil was dilated and did not react to light or in accommodation. Other paradoxic movements of elevation are discussed and compared with the one reported. The theory of aberrant regeneration of nerve fibers seems to be the most plausible explanation. (Photographs.) J. Hewitt Judd.

Guyton, J. S., and McLean, J. M. **Isolated rheumatic nodule of the upper eyelid.** Amer. Jour. Ophth., 1939, v. 22, Sept., pp. 985-992.

Harner, C. E. **Nasolacrimal drainage after combined external and intranasal tear-sac operation.** Amer. Jour. Ophth., 1939, v. 22, Aug., p. 907.

Klauber, E. **Conjunctival transplantation in the operative treatment of trichiasis.** Ann. d'Ocul., 1939, v. 176, June, pp. 476-477.

The author previously used Van Milligan's operation of transplantation of buccal mucous membrane in the treatment of trichiasis. Because of the impossibility of asepsis of the mouth, the patient's discomfort at having the inner surface of the lip denuded, and other technical difficulties, the graft is now satisfactorily taken from the bulbar conjunctiva instead of from the lips. John M. McLean.

Kravitz, Daniel. **Hodgkin's disease of the lid.** Arch. of Ophth., 1939, v. 21, May, pp. 844-852.

A small cystic tumor at the superior orbital border near the inner angle, which clinically appeared to be a fibroma, was removed and found to be typical of Hodgkin's disease. The literature is reviewed with special reference to etiology, differential diagnosis, course, treatment, and prognosis. (Photomicrographs.)

J. Hewitt Judd.

Lauber, H. **A case of blepharoplasty.** Ophthalmologica, 1939, v. 97, July, p. 312.

In a 17-year-old boy, a basal-cell carcinoma arose in the upper lid, presumably in consequence of radium treatment of an angioma when he was three years old. Three plastic operations (Filatov's blepharoplasty with round stalk, repeated once, and free skin-graft taken from the upper arm) ended in necrosis of the flap. A flap with double insertion brought down from the forehead was successful. The necroses and the copious bleeding which accompanied each operation were ascribed to the effects of the radium.

F. Herbert Haessler.

Laval, Joseph. **Congenital fistula of the lacrimal sac.** Amer. Jour. Ophth., 1939, v. 22, Sept., pp. 1022-1023.

Natanson, M. S. **Lysozyme in the therapy of blepharitis.** Viestnik Opht., 1939, v. 14, pt. 5, p. 22.

Lysozyme was used in 104 cases of various types of blepharitis; its effect was good even in old cases, with complete cures in 19.5 percent of oily, 11.8 percent of squamous, and 9.7 percent of ulcerative blepharitis. Improvement took place in 61 percent of ulcerative, 79 percent of squamous, and 72 percent of oily blepharitis. Ray K. Daily.

Pozzo, Ezio Da. **True congenital distichiasis.** Bull. d'Ocul., 1938, v. 17, Dec., pp. 1015-1034.

A woman of 27 years had a number of supplementary eyelashes on the posterior lip of the lid margins, forming at their implantation an angle of 90° with the normal cilia. They were grayish-black in color and 2 to 4 mm. long. Her boy of five years, who was affected also by syndactilia, showed the same anomaly. Trachoma was excluded. At the microscope the lashes appeared to have no medullary substance and their follicles were surrounded by sebaceous-like glands (rudimentary meibomian glands). In regard to the etiopathogenetic problem, the writer believes that this is a recessive and regressive malformation. The piliferous meibomian gland is analogous to that seen in some lower animals. Bibliography, 5 figures.) M. Lombardo.

Reitsch, **Treatment of lacrimal affections by tamponade salve.** Klin. M. f. Augenh., 1939, v. 102, June, p. 846.

An ointment having a melting point of 39 degrees is converted into liquid form by warming and is then introduced into the lacrimal passages by means of a syringe and allowed to harden. It is left in place from one to

four days, remaining in contact with the inflamed mucous membrane.

C. Zimmermann.

Savin, L. H. **A note of three cases showing "crocodile tears" after facial paralysis.** Brit. Jour. Ophth., 1939, v. 23, July, pp. 479-482.

The author credits Tumarkin, who reported 13 cases (Lancet, 1936, v. 1, p. 26) as advancing the most reasonable explanation for the peculiarity. A diagram of the nerves involved in the production of the "crocodile tears" accompanies the discussion and clarifies the clinical aspects outlined. The author reports cases observed since the publication of Tumarkin's papers. The first two cases discussed refused to undergo partial excision of the lacrimal gland, stating they had become tolerant of their condition; while the third case, with the ganglion blocked by cocaine, experienced no relief even of a temporary nature. The experiment was not deemed convincing in that a concurrent conjunctivitis was also present. (Figure, references.)

D. F. Harbridge.

Stokes, W. H. **Transplantation (implantation) of the lacrimal sac in chronic dacryocystitis.** Arch. of Ophth., 1939, v. 22, Aug., pp. 193-210; also Trans. Amer. Acad. Ophth. and Otolaryng., 1938, 43rd mtg., p. 342.

After reviewing the various methods of treating chronic dacryocystitis by creation of an artificial passageway into the nose, the author describes his technique of implantation of the lower end of the tear sac into the nose through a trephine opening, 8 to 10 mm. in diameter, in the ascending process of the maxilla. Three silk sutures are placed in the lower end of the sac after it is cut through completely as far down as possible. The sutures are drawn through the nostril to hold the sac in the bony canal. The results in 42 operations on 39 patients are summarized and presented in a table. Three cases in which failure occurred are reported, illustrating that any coexisting nasal pathology must be corrected as a preliminary step, and that this procedure is not suitable for atrophic sacs. The steps of the operation are shown by drawings. (Discussion.)

J. Hewitt Judd.

Tooke, F. T. **A case of aleukemic lymphosis involving the upper lids.** Brit. Jour. Ophth., 1939, v. 23, July, pp. 444-454. (See Amer. Jour. Ophth., 1939, v. 22, Sept., p. 1060.)

Von der Heydt, R. **Dermatological lesions about the eyes.** Trans. Amer. Acad. Ophth. and Otolaryng., 1938, 43rd mtg., p. 25.

The author lists 37 dermatologic lesions of the eyelids with their manifestations in the eye itself.

George H. Stine.

15

TUMORS

Charamis, J. **Clinical, anatomic, and microscopic study of six cases of choroidal sarcoma.** Bull. Soc. Hellénique d'Opht., 1939, v. 8, Jan.-March, p. 92.

Six cases of choroidal sarcoma are analyzed from the standpoints of ophthalmoscopic picture, localization, consistency, pigmentation, vascularization, and cell type. George A. Filmer.

Ciotola, Guido. **A case of flat melanosarcoma of choroid.** Boll d'Ocul., 1938, v. 17, Dec., pp. 991-1003.

A man of 70 years had his right eye enucleated for intraocular growth. Section of the eye showed that the neo-

plasm extended from the iris to the optic nerve, being 2 mm. thick anteriorly, 1 mm. at the equator, and 2 to 3 mm. at the posterior pole, and occupying about three-fifths of the uveal tract. It appeared to be rich in pigment and was composed of round and spindle cells. The author believes that it originated from a formation resembling a nevus of the uvea. (Bibliography, 5 figures.) M. Lombardo.

Grancini, L. E. **Meningioma of the orbit.** Rassegna Ital. d'Ottal., 1939, v. 8, March-April, pp. 179-196.

Grancini discusses the modern histologic knowledge of tumors of the orbit and in particular, the meningioma. The meningeoblast is a particular cell, neither connective tissue nor epithelium, but as autonomous as the cells of Schwann or the glial cells. Orbital meningiomas are much rarer than similar intracranial growths. The patient described was a woman of 41 years in whom the tumor arose from the upper wall of the left orbit. The exophthalmos measured 10 mm. The tumor was incompletely removed surgically but was later treated intensively with X rays and radium. After four years the patient was clinically cured. (5 figures.) Eugene M. Blake.

Martin, H. E. **Cancer of the eyelids.** Arch. of Ophth., 1939, v. 22, July, pp. 1-20.

This paper is based on the study of 147 cases of cancer of the eyelid treated at the Memorial Hospital between 1925 and 1935. The author discusses the etiology, symptoms, clinical course, diagnosis, incidence of types, and the selection and technique of treatment. While cancer of the eyelid is not a highly fatal disease, the growth or its treatment may result in impairment of vision or a cosmetic defect. Although many smaller lesions may be treated by either irradiation or surgical excision, with acceptable end results, moderately sized growths are more satisfactorily treated by irradiation. Extensive tumors often require radical surgical excision or a combination of irradiation and surgical excision. The article is illustrated by photographs showing tumors of various types and locations before and after treatment by various methods. J. Hewitt Judd.

Meyer, F. W. **Recklinghausen's neurofibromatosis and the eye.** Klin. M. f. Augenh., 1939, v. 103, July, p. 44.

A farm laborer of 29 years showing mental debility and endocrine disturbances, stated that his right upper lid had been growing larger for several years. It was unusually thickened and hung down over the lower lid like an apron. The diagnosis of neurofibroma with elephantiasis was confirmed by histologic examination of skin nodules on the left shoulder. The lid tumor was later extirpated. C. Zimmermann.

Pincus, Ludwig. **Neoplasms of the iris.** Ophthalmologica, 1939, v. 97, July, p. 302.

The author describes four neoplasms of the iris: (1) A spindle-cell sarcoma in a boy of sixteen years which was removed in 1934 by iridectomy. It recurred in 1936 and after a second iridectomy the eye remained well. (2) A ring sarcoma of the iris that developed primarily as a ring sarcoma. (3) A tumor which originated from the cells of the secondary optic vesicle, probably a genuine glioma, in a man thirty years of age. (4) An endothelial neoplasm which presumably arose by proliferation of persistent embryonic cells in the chamber angle. F. Herbert Haessler.

Rand, C. W., Irvine, R., and Reeves, D. L. **Primary glioma of the optic nerve.** Arch. of Ophth., 1939, v. 21, May, pp. 799-816.

A four-year-old boy had presented a slowly progressing unilateral exophthalmos for one year. At intracranial exploration the nerve was found to be symmetrically enlarged starting about 1.5 cm. from the chiasm and extending forward to the globe. The tumor proved to be a polar spongioblastoma. One month later the eye with the remaining portion of the nerve was enucleated, and recovery was uneventful. The authors point out the unjustifiable hazard involved with an incomplete orbital removal since intracranial extension of the tumor occurs in a high proportion of cases. Technically, complete extirpation is more certain and meningitis less likely to occur if done through the intracranial approach. The diagnostic signs are atrophy of the optic nerve or optic neuritis, slowly progressive nonpulsatile exophthalmos, and roentgenographic evidence of enlargement of the optic foramen. J. Hewitt Judd.

Schreck, Eugen. **Clinical and pathologic anatomy of orbital tumors.** Klin. M. f. Augenh., 1939, v. 103, July, p. 1.

Schreck investigated 259 clinical histories in the eye clinic at Heidelberg from 1900 to 1937 as to whether clinical diagnosis of orbital tumor could be verified by subsequent pathologic examination. Frequency and definite clinical symptoms of the different kinds of tumor were recorded. A total of 190 patients had been operated upon and the specimens systematically classified according to pathologic findings.

C. Zimmermann.

Sharp, G. S. **The treatment of cancer of the eyelids.** Trans. Sec. on Ophth., Amer. Med. Assoc., 1938, 89th mtg., p. 77.

From 1932 to 1937 inclusive 62 consecutive patients with cancer of the eyelids were treated by surface and interstitial irradiation, the technique of which is described. It is the author's opinion that the prognosis for cancer of the eyelids is excellent when irradiation is used. Six cases are described in detail and illustrated. (Discussion.)

George H. Stine.

Trantas, A. **Melanoma of the choroid.** Bull. Soc. Hellénique d'Opht., 1939, v. 8, Jan.-March, p. 43.

The author recommends the use of the diaphanoscope in searching for melanomas of the choroid. With this method he has discovered ten times as many tumors as he had found with the ophthalmoscope. George A. Filmer.

Wilder, H. C., and Callender, G. R. **Malignant melanoma of the choroid. Further studies on prognosis by histologic type and fiber content.** Amer. Jour. Ophth., 1939, v. 22, Aug., pp. 851-855.

16

INJURIES

Gorovaja, G. X., and Rapoport, M. X. **Chalcosis of the eyeball.** Viestnik Opht., 1939, v. 14, pt. 5, p. 47.

A review of the literature and report of three cases; two following injuries with penetration of a copper particle into the eyeball, and one following a year's use of a copper ointment for trachoma. Ray K. Daily.

Juraszynska, Janina. **The value of biomicroscopy of ocular injuries.** Klinika Oczna, 1939, v. 17, pt. 3, p. 346.

A description of the biomicroscopic pictures of a number of ocular injuries,

and a plea for more extensive use of biomicroscopy. (Illustrations.)

Ray K. Daily.

Mitskevich, L. D. **Three cases of perforating ocular injuries with invasion of the iris by multiple foreign bodies.** Viestnik Opht., 1939, v. 14, pt. 6, p. 77.

A report of three cases of ocular injuries caused by accidents in blasting, with invasion of the conjunctiva, sclera, cornea, and iris by numerous particles of carbon, stone, quartz, and similar substances. The conclusions are that minute particles of such foreign bodies are tolerated well by the cornea and iris, provided no infection sets in. Open treatment of burns and wounds of the adjacent skin serves to prevent secondary infection of the ocular injuries, while treatment with ointments and bandages is conducive to infection.

Ray K. Daily.

Nergler, Stefania. **Intraocular foreign bodies.** Klinika Oczna, 1939, v. 17, pt. 3, p. 437.

An analysis of 130 intraocular foreign-body cases treated at the Ophthalmic Institute of Warsaw during the five years, 1933 to 1938. In general the data indicate that the prognosis becomes poorer in proportion to the depth to which the foreign body penetrates the eyeball and to the delay in its extraction. Ray K. Daily.

Smelanski, P. I. **Traumatism of the optic nerves.** Viestnik Opht., 1939, v. 14, pt. 6, p. 49.

A report of a case of evulsion of the optic nerve from the globe, caused by an injury from a knife penetrating through the upper inner angle of the orbit. Ray K. Daily.

Stroobants, C., and Schepens, C. **Acetylarsan and accidents related to the visual apparatus.** Ann. d'Ocul., 1939, v. 176, July, pp. 519-537.

Arsenical derivatives used in medicine are divided into two groups: (1) those which are only weak spirillicides and which have general toxic properties (inorganic arsenicals and the acyclic organic arsenicals), and (2) those which are strong spirillicides (cyclic organic compounds). Ocular accidents practically never occur from arsenicals in the first group. Chemistry of the second group is discussed. The most toxic compounds are atoxyl and arsacetine. Many cases of serious optic neuritis have resulted from these drugs. Other derivatives such as stovarsol, tryparsamide, and acetylarsan are much less dangerous, but still can cause blindness. Acetylarsan can cause a variety of toxic manifestations. One case is reported with bilateral optic neuritis. Symptoms of involvement do not often appear after two or three injections of acetylarsan; sometimes, however, they are observed after the tenth or even the twentieth injection. They consist of photopsia, repeated loss of visual field, and reduction of visual acuity. The visual field usually takes an oval form with the long axis horizontal. The author raises the question whether these signs and symptoms are really drug intoxication or the result of syphilis, occurring in the ordinary course of the disease or as a neurorecidive. The fact that several cases have been reported where this drug was used in diseases other than syphilis, the fact that most cases of intoxication follow excessive dosages, and the fact that the lesion seems to take a typical course, getting worse and not better, and that there is no related inflammatory lesion, all point toward drug intoxication. In order to avoid these unfortunate effects careful physical examination with emphasis on

the circulatory system, liver, nervous system, urinalysis, and blood-urea determination is recommended during treatment with such a drug. When the optic nerve does become involved the drug must be stopped at once and sodium hyposulphite administered both intravenously and by mouth for at least a month. If the retinal vessels are contracted vasodilators are also advised. In spite of the danger of ocular intoxication, treatment of ocular lesions with this drug is recommended if the general physical examination seems favorable and if the eye lesions are definitely due to syphilis. John M. McLean.

Winkler, A. **Carbolic-acid burn of both eyes and general sequelæ, with remarks on the therapy of chemical burns of the eye.** Klin. M. f. Augenh., 1939, v. 102, June, p. 810.

A mixture of 50 percent phenol, 25 percent cresolen and 10 percent xylenol squirted under pressure into the face of a laborer, causing third-degree burns of both eyes and the face. Toxic action of the absorbed phenol damaged the kidneys and hematopoietic apparatus, producing a severe anemia. The therapy has been conservative in 215 similar cases seen within the last five years at the eye clinic of Halle.

C. Zimmermann.

17

SYSTEMIC DISEASES AND PARASITES

Falcao, Theophilo. **Ophthalmic zona and its treatment by neosalvarsan and ultraviolet rays.** Trabalhos do Primeiro Cong. Brasileiro de Ophth., 1936, v. 2, pp. 447-449.

A ten-year-old patient with ophthalmic zona was successfully treated with ultraviolet rays and injections of neosalvarsan. Similar cases treated with neosalvarsan and reported in the literature are mentioned.

Ramon Castroviejo.

Moore, T. I. **Arachnodactyly.** Arch. of Ophth., 1939, v. 21, May, pp. 854-855.

The case reported is that of a boy aged six years who presented the typical findings including congenital heart disease. No others in the family were affected. (Photographs.)

J. Hewitt Judd.

O'Brien, C. S., and Allen, J. H. **Ophthalmomyiasis interna anterior.** Amer. Jour. Ophth., 1939, v. 22, Sept., pp. 996-998.

Przylbylkiewicz, Z., and Madroskiewicz, M. **The value of Löwenstein's method in the diagnosis of ocular tuberculosis.** Klinika Oczna, 1939, v. 17, pt. 3, p. 377.

A review of the literature relative to Löwenstein's method of culturing tubercle bacilli from the blood of tuberculous patients, and a tabulated report of 37 blood cultures (31 from patients with ocular diseases and 6 from known tuberculous patients), all negative.

Ray K. Daily.

Reitsch, W. **Ciliary neuralgia.** Klin. M. f. Augenh., 1939, v. 102, May, p. 706.

After an intense nasal catarrh, the author noted a painful spot near his right nasal bone at the border of the lateral cartilage, probably an ulcer. Simultaneously a right-sided ciliary pressure pain occurred on closure and lateral movements of the eyes. The ciliary pain was relieved by diminishing the nasal pain (larocaine sponges), and disappeared with healing of the nasal affection. As the nasal mucous membrane is supplied by the anterior ethmoidal nerve (a branch of the ophthalmic nerve), the reflex action from

the nose on the ciliary nerve is explained. In ciliary pain of obscure origin search should be made for sensitive places in the nose and, even if not found, anesthesia of the nasal mucous membrane may be tried for relief.

C. Zimmermann.

Viallefont, Harant, and Temple. **Ocular euliasis.** Ann. d'Ocul., 1939, v. 176, June, pp. 417-435.

The authors have used the term "euliasis," derived from the Greek word for larva, to designate parasitic involvement of the eyes. An extensive review of the literature is given and two cases (adults) are briefly reported. In one a small irritative subconjunctival foreign body removed under local anesthesia at the slitlamp proved to be a primary larva of "Oestrus ovis." In the second case six small white larvæ under the conjunctiva were similarly removed. In both cases removal was followed by full relief of symptoms.

John M. McLean.

Wile, U. J. **Constitutional background, differential diagnosis, and treatment of dermatological lesions about the eyes, ears, nose, and throat.** Trans. Amer. Acad. Ophth. and Otolaryng., 1938, 43rd mtg., p. 43.

This address discusses a variety of conditions and does not lend itself to abstracting.

18

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Alvaro, M. E. **Importance of social service in the practice of ophthalmology.** Trabalhos do Primeiro Cong. Brasileiro de Ophth., 1936, v. 2, pp. 493-497.

The author discusses at length his recent tour of the United States, during which he had the opportunity of observing how the social service operated in connection with ophthalmic clinics.

Ramon Castroviejo.

Andrade, C. de, and Ferreira, L. **The greatest factors of blindness in Bahia.** Trabalhos do Primeiro Cong. Brasileiro de Ophth., 1936, v. 2, pp. 505-509.

Statistics of causes of blindness in the state of Bahia during the past twenty years. Ramon Castroviejo.

Bardelli, Lorenzo. **The new Clinica Oculistica of Florence.** Boll. d'Ocul., 1936, v. 17, Dec., pp. 961-977.

A detailed description is given of the new institute, which includes 133 beds thirty of which are located in the isolation pavilion. M. Lombardo.

Beach, S. J. **Problems in special study for general physicians.** Jour. Amer. Med. Assoc., 1939, v. 113, Aug. 26, p. 731.

The influence of the American Board of Ophthalmology has led to great improvement in the training of ophthalmologists. The opportunities for physicians without formal training are, however, totally inadequate. Four expedients are discussed. George H. Stine.

Berens, Conrad. **Standards for outpatient service in ophthalmology.** Amer. Jour. Ophth., 1939, v. 22, Aug., pp. 870-875.

Cantamessa, Gustavo. **The eye and painting.** Boll. d'Ocul., 1938, v. 17, Dec., pp. 1035-1040.

Form and colors are the objects of vision, and form and colors constitute the representation of a picture. This relationship is affected in individuals with uncorrected or uncorrectable ametropias, with dyschromatopsias, and in monocular vision. The influence that

these conditions may have is discussed in detail by the writer. Artists with myopia or hyperopia give to their works synthetic and poorly defined outlines, according to analogous alterations in their retinal images. The astigmatic have an imperfect vision in the horizontal, vertical, or oblique lines which has its influence on the picture or design. The artist with monocular vision gives less relief to objects and figures because of his lack of stereoscopic sense. Color tone of the retinal images depends on the quantity of light entering the eye through the sclera, being colder if the light penetrates in greater quantity. This penetration is greater in blonds, who tend to give to their pictures a cold tone, and less in brunettes, who prefer a warm tone.

M. Lombardo.

Esser, A. A. M. **Etiology of blindness in antiquity.** Klin. M. f. Augenh., 1939, v. 103, July, p. 100.

Esser speaks of the chemical and physical causes of blindness found in ancient literature and mentions Xenophon as the first to report snow blindness.

C. Zimmermann.

Figueira de Mello, Francisco. **Illumination in public, private, and high schools in the capital of São Paulo.** Trabalhos do Primeiro Cong. Brasileiro de Ophth., 1936, v. 2, pp. 489-491.

The author reports the results of his study of light conditions in the private and public schools of São Paulo.

Ramon Castroviejo.

Gomes, P., and Alvaro, M. E. **Causes of blindness at the Padre Chico Institute.** Trabalhos do Primeiro Cong. Brasileiro de Ophth., 1936, v. 2, pp. 470-487.

The authors estimate that there are about 40,000 blind people in the U. S. of Brazil. In the absence of complete statistics on the causes of blindness, they studied 87 cases at the Padre Chico Institute. It was found that 31 had lost the visual function on account of corneal lesions and 27 because of lesions of the globe as a whole. Thirteen cases presented opacification of the lens accompanied by lesions of the fundus. Postmeningitic optic atrophies were observed in 6 cases, and optic atrophies following lesions of the retina in 6 more; 4 cases showed primary optic atrophy. There was one case of disseminated chorioretinitis and another of pupillary occlusion. Etiologic factors of the different lesions are quoted as follows: ophthalmia neonatorum 35 cases, trachoma 10, syphilis 10, different exanthemata 4. Two cases were due to severe burns, one of them from radium. Two cases were due to failure of decompressive operations in the treatment of buphthalmos. Of the 24 other cases, the etiology was difficult to determine.

Ramon Castroviejo.

Gordon, B. L. **Oculists and occultists; demonology and the eye.** Arch. of Ophth., 1939, v. 22, July, pp. 25-65.

The psychologic principle on which the therapeutic effect of suggestion depends is based on the faith that each person has in the healer, whether the method employed is that of mumbling magic formulas or that of suggestion as used by psychiatrists. The author traces the development of demonology in its relation to medicine from the periods of ancient Egypt, Assyria, Greece, and Rome to medieval Christianity and down to modern mesmerism, hypnotism, Christian Science, spiritualism, and Couéism. Many present-day beliefs and superstitions can be traced back to the demonic beliefs found in the Old

Testament and in the middle ages. The author lists the names of pathogenic demons and the patron saints of diseases, and discusses the supposed habits and modes of transmission of demons, the use of protective amulets, exorcism, and physical remedies to expel demons.
J. Hewitt Judd.

Higgins, S. G. **Ophthalmic surgery at missions in India.** Amer. Jour. Ophth., 1939, v. 22, Aug., pp. 876-881.

Jensen, A. F., and Gradle, H. S. **The need for social-service work in glaucoma.** Amer. Jour. Ophth., 1939, v. 22, Sept., pp. 993-995.

Korb, J. H. **Perception time and nightblindness.** United States Naval Med. Bull., 1939, v. 37, July, p. 392.

Using the biophotometer, 630 individuals in different branches of the naval service were tested for nightblindness. Those classified below normal included 5.17 percent of naval aviators, no naval-aviation pilots, 19.26 percent of chief petty officers, and 19.45 percent below the rank of chief petty officer. George A. Filmer.

Lewis, Park. **The responsibility of the medical profession in the prevention of blindness.** Trabalhos do Primeiro Cong. Brasileiro de Ophth., 1936, v. 2, pp. 511-514.

The author reviews the work done in the United States for the prevention of blindness, especially in cases of ophthalmia neonatorum and syphilis.
Ramon Castroviejo.

Lijo, Pavia. **International Association for the Prevention of Blindness. The work of the National Argentine Committee.** Trabalhos do Primeiro Cong. Brasileiro de Ophth., 1936, v. 2, pp. 471-474.

This committee has carried out through subcommittees in charge of each province a campaign to create schools for amblyopic children. All children attending school were thoroughly examined for ocular disease and refracted. Ramon Castroviejo.

Motais, F. **Can a change of residence or living conditions attenuate the virulence of endemic trachoma?** Rev. Internat. du Trachome, 1939, v. 16, April, p. 88.

In Cambodia and Northern Cochinchina the author found that, although from 50 to 80 percent of the native coolies were affected with trachoma, the percentage of invalidity from the disease was very low.
J. Wesley McKinney.

Pereira, Dulcidio. **Modern illumination as a factor of visual hygiene.** Trabalhos do Primeiro Cong. Brasileiro de Ophth., 1936, v. 2, pp. 453-467.

A lengthy discussion on the subject of illumination as a problem of ocular hygiene. Ramon Castroviejo.

Pimentel, P. C. **Sight-conservation classes.** Trabalhos do Primeiro Cong. Brasileiro de Ophth., 1936, v. 2, pp. 499-503.

The author discusses at length the work done in the United States and Germany in sight-conservation classes.
Ramon Castroviejo.

Rotter-Musialowa, J. **The problem of blindness from the standpoint of therapy.** Klinika Oczna, 1939, v. 17, pt. 3, p. 443.

A description of the work of all agencies (medical, educational, and financial) engaged in assisting the blind. The author points out the inadequacy of existing agencies, and the shortage

and poor distribution of ophthalmologists. Ray K. Daily.

Snell, A. C. **Visual acuity; its relation to the form sense and the application of this relationship to medicolegal problems.** Trans. Sec. on Ophth, Amer. Med. Assoc., 1938, 89th mtg., p. 38.

A method for computing the functional and proportionate values for acuity notations has been established, and by this method each increase in the visual angle reduces visual resolving power (efficiency) by the same percentage. In the application of this method to the medicolegal problem of evaluating disabilities for identical degrees of damage to function, identical percentage losses are established. (One table, discussion.) George H. Stine.

Spinola, Colombo. **Prevention of blindness, organization in Bahia.** Trabalhos do Primeiro Cong. Brasileiro de Ophth., 1936, v. 2, pp. 481-487.

After reporting measures for prevention of blindness carried out in different American and European countries, the author mentions the work of the Santa Lucia Foundation located in the state of Bahia, Brazil.

Ramon Castroviejo.

Spiratos, Spyridon. **The infectious eye diseases in Greece (Athens).** Klin. M. f. Augenh., 1939, v. 102, June, p. 806.

Since 1932 the laboratories of the university ophthalmic and gynecologic clinics have studied the general consequences of various infectious eye diseases, and the normal and pathologic bacterial flora. From 1928 to 1934 103,657 patients were treated at the eye clinic. The conditions included trachoma (8.91 percent) and acute conjunctivitis (8.78 percent). Of 714 cases of acute conjunctivitis, pneumococci were found in 77 (10.7 percent), diplobacilli of Morax-Axenfeld in 41 (5.7 percent), streptococci in 21 (2.5 percent), Koch-Weeks bacilli in 358, and no micro-organisms in 86 (12.0 percent). The incidence of Koch-Weeks bacillus was highest in October and November, lowest in February and March. The occurrence with xerosis bacillus was frequently observed. Mixed infection with pneumococci is dreaded on account of epithelial desquamation and serpent ulcer.

C. Zimmermann.

Tiscornia, A., and Vila Ortiz, J. M. **Trachomatous patients and the industrial accident law.** Ann. d'Ocul., 1939, v. 176, June, pp. 451-466.

After detailed discussion of the legal aspects of trachoma in industrial ocular accidents, the author proposes certain general rules to be followed in the examination and management of such cases, and also in medicolegal decisions concerning them. John M. McLean.

Thacker, E. A. **A study of ocular defects among university students.** Amer. Jour. Ophth., 1939, v. 22, Sept., pp. 1003-1011.

Tupinamba, Jacques. **Statistic studies of external ocular affections in school groups in São Paulo.** Trabalhos do Primeiro Cong. Brasileiro de Ophth., 1936, v. 2, pp. 475-479.

Statistics furnished by the Department of Public Health of different ocular conditions observed in school children in São Paulo. Ramon Castroviejo.

19

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Abashidse, S. **The development of secondary vitreous.** Viestnik Opht., 1939, v. 14, pt. 6, p. 53.

Histologic studies of embryos of various ages lead the author to conclude that the primary and secondary vitreous are formed by the lens, retina, and blood vessels. The lens contributes fibers to the secondary vitreous until the development of the hyaloid membrane forms a barrier between the two structures, which occurs, according to Mann, in the 13-mm. or 5-week embryo. In the author's specimen this did not take place until the end of the second month (39-mm. embryo). The contribution of the mesoderm to the secondary vitreous ceases with the obliteration of the vasa hyaloidea propria.

Ray K. Daily.

Crozier, W. J., and Wolf, E. **The flicker-response contour for the gecko (rod retina).** Jour. Gen. Physiology, 1939, v. 22, May 20, p. 555.

The flicker-response contour for the gecko, a nocturnal animal which has a retina with only rods, agrees in all essential respects with that for the turtle which has a cone retina. This shows that assumptions from comparative histologic evidence concerning the properties of rods and cones in relation to visual performance may be quite misleading. T. E. Sanders.

Crozier, W. J., and Wolf, E. **Temperature and critical illumination for reaction to flickering light. 4. Anax nymphs.** Jour. Gen. Physiology, 1939, v. 22, July 20, p. 795.

Testing nymphs of the dragon fly Anax, it was found that the critical illumination for response to visual flicker falls continuously as the temperature rises, flash frequency and light-time fraction in the flash cycle being kept constant.

George A. Filmer.

Lyle, D. J. **Arrests in embryologic development as factors in vision; brief review of the embryology of the eye with associated anomalies of arrested development.** Arch. of Ophth., 1939, v. 21, June, pp. 1037-1054.

Some of the more common conditions found in the eye as a result of arrested development of the ectodermal and mesodermal structures are presented and discussed. The various influences causing the disturbances and the mechanism by which the aberrations occur are considered. (Photographs.)

J. Hewitt Judd.

Wald, George. **The porphyropsin visual system.** Jour. Gen. Physiology, 1939, v. 22, July 20, p. 775.

Instead of rhodopsin, a purple pigment porphyropsin is found in the rods of fresh-water fish. This pigment is photolabile and participates in a retinal cycle identical in form with that of rhodopsin. Chemically, porphyropsin differs from rhodopsin in an added ethylene group in the polyene chain.

George A. Filmer.

NEWS ITEMS

Edited by Dr. H. Rommel Hildreth

640 S. Kingshighway, Saint Louis, Missouri

News items should reach the Editor by the twelfth of the month

Deaths

Dr. Josiah Shaftesbury Davies, Tacoma, Washington, died July 11, 1939, aged 60 years.

Dr. James Alfred Watson, Minneapolis, Minnesota, died June 17, 1939, aged 71 years.

Dr. John Alexander Donovan, Butte, Montana, died July 21, 1939, aged 67 years.

Dr. Vincent Joseph Irwin, Springfield, Massachusetts, died June 19, 1939, aged 81 years.

Miscellaneous

The ninth annual Midwinter Clinical Course in Ophthalmology and Otolaryngology at Los Angeles will be given by the Research Study Club January 15 to 26, 1940. The teaching staff will include: Dr. George L. Tobey, Jr., of Boston, Massachusetts; Dr. William J. McNally, of Montreal, Quebec, Canada; Dr. Albert D. Ruedemann, of Cleveland, Ohio; Dr. Algernon B. Reese, of New York City; Dr. Meyer Wiener, of Saint Louis, Missouri; Dr. Edward Jackson, of Denver, Colorado; Dr. John F. Barnhill, of Indianapolis and Miami Beach, Florida; Dr. Simon Jesberg, of Los Angeles, California; Vern O. Knudson, Ph.D., of Los Angeles, California; Dr. Augustus G. Pohlman, of Los Angeles, California; Dr. Louis K. Guggenheim, of Los Angeles, California, and Norman A. Watson, Ph.D., of Los Angeles, California.

The Manhattan Eye, Ear, and Throat Hospital Department of Ophthalmology graduate instruction to the resident staff schedule of evening lectures announces the following lecturers for 1939-1940: Drs. P. Montalvan, M. A. Last, C. Dunn, Joseph Laval, A. A. Eggston, R. T. Paton, R. E. Buckley and H. B. Field. Lectures begin at 7 p.m. Hospital residents and graduate students are invited to attend.

Societies

The Kansas City Society of Ophthalmology and Otolaryngology announces the following officers for 1939-1940: President, Dr. Arthur N. Altringer; 1st vice-president, Dr. Alvin J. Baer; 2d vice-president, Dr. Wilson K. Hobart; secretary, Dr. Desmond Curran; treasurer, Dr. John McLeod.

The Ophthalmological Society of Australia met at Melbourne, April 19. Illness of the president, Sir James Barrett, prevented his attendance, and the vice-president, Dr. James Flyn, read his president's address on "Blindness and the history of Braille type." Miss Ida Mann brought greetings from the Ophthalmological Society of the United Kingdom and the Section of the British Medical Association, and gave two lectures on "Developmental abnormalities of the eye." She was elected the first honorary member of the Society. Birth injuries to the eye, progressive exophthalmos, orbital tumors, and bullous keratitis were discussed. A visit was made to the Royal Victoria Institute for the Blind.

Personals

Dr. Peter Kronfeld has recently resigned from the faculty of the Union Medical College of Peiping, China, to accept a full-time position as dean of instruction at the Illinois Eye and Ear Infirmary, Chicago. Dr. Kronfeld will have full charge of all graduate and postgraduate work at the Infirmary and will limit his outside activity to ophthalmologic consultation.

Dr. Raymond J. Gray has recently changed his address from 212 Bigham Street, Pittsburgh, Pennsylvania, to 5103 Jenkins Arcade, Pittsburgh. Practice is limited to ophthalmology.